Hydrology Study--A Multipurpose Program For Selected Cumulative Probability-Distribution Analyses

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U.S. DEPARTMENT OF AGRICULTURE
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PREFACE

The Central Technical Unit, Hydrology Branch, Engineering Division, Soil Conservation Service (SCS), U.S. Department of Agriculture (USDA), uses electronic data processing (EDP) to make volume-duration-probability (VDP) analyses of runoff for selected watersheds. Annual maximum streamflow data for periods of 1, 3, 7, 15, 30, 60, 90, 120, 183, and 274 days are furnished to SCS by the U.S. Geological Survey (USGS).

The EDP programs described in this technical paper: (1) Transfer USGS taped data directly to punched cards ready for processing, (2) perform all the statistical computations needed to obtain the maximum annual volume of flow at each selected percent chance for the 10 listed periods, and (3) plot the computed results on log normal probability charts. The principal program (0872) uses the two-parameter gamma distribution to compute the 0- to 99-percent chance events unless the gamma shape factor exceeds 51; then it uses the log normal distribution. The program develops a wide range of statistics that apply to most cumulative probability-distribution analyses of natural data in the earth-science field.

The programs have been developed jointly by the Mathematical and Survey Applications Section, Washington Data Processing Center, Statistical Reporting Service (SRS), and the Central Technical Unit, Hydrology Branch, Engineering Division, SCS, USDA. They are written in FORTRAN II for processing through the IBM 7074, IBM 1401, and EAI Dataplotter Model 3300 equipment available in the Washington Data Processing Center.[1/]

This technical paper includes source programs, tabular data, instructions for preparing input data, and some examples of application. It is primarily a reference to the analyses being made in the Soil Conservation Service. It is intended also as a guide for making similar analyses by other technicians who are familiar with electronic data processing.

1/ Trade names are used in this publication solely to provide specific information. Mention of a trade name does not constitute an endorsement by USDA over other products not mentioned.

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HYDROLOGY STUDY--A MULTIPURPOSE PROGRAM FOR SELECTED CUMULATIVE PROBABILITY-DISTRIBUTION ANALYSES

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IBM 7074 PROGRAM ABSTRACT

Title: Hydrology study--a multipurpose program for selected cumulative probability-distribution analyses

Program: 0872

Job No.: 920603-0010

Date: September 1963

Purpose: To compute various statistics from hydrologic or other data.

Equipment specifications:

(a) 10,000 word 7070/72/74 series
(b) Seven tape units:
    One program tape
    Two input tapes (units 10 and 21)
    Four output tapes (units 11, 12, 20, and 22)
(c) Compiled without floating-point hardware

Source language: FORTRAN

Accuracy: Single precision floating point

PROGRAM 0872 WRITEUP

A. Title: Hydrology study--a multipurpose program for selected cumulative probability-distribution analyses

B. Authors: Elgin G. Fry, Head, Mathematical and Survey Applications Section, Washington Data Processing Center, SRS, USDA, and William H. Sammons, Central Technical Unit, SCS, USDA

C. Description: This program reads specified control input data (described in later sections) that give information to the computer concerning the number of lines plus the beginning- and ending-line numbers of any desired sets of 100 lines for the specified input. A maximum of 10 sets can be requested. A line is one horizontal line of input data on one IBM 80-column card. Only 79 columns are used; see data card format.

A maximum of 100 lines can be processed for each station. Each line card is prepared as outlined on SRS-DP-102, Multiple-Card Layout Form, page 11. The program assumes that the decimal is placed just before the last position of each field. Punching of decimals in the data cards overrides the program and the data field will be read incorrectly.

Input data as mean discharge for 10 selected periods, i.e., 1, 3, 7, 15, 30, 60, 90, 120, 183, and 274 days, are arranged in descending order of magnitude of the original data values. The values are converted to log to base 10 and then to inches. The following values are written as output for each stream gage:

Original values from high to low
Log to base 10 of original values
Mean discharge converted to inches of runoff

Additional values required for automatic data plotting are outlined in E.

D. Principal statistics:

1. Number of lines per station (N)

where $X > 0$; $2 \leq N \leq 100$

N is printed.

2. Coefficient of variation (CV)

Used with arithmetic normal, extreme value, etc., for small values of CV; assumes no outliers in the sample size, N.

$$CV^2 = \frac{N^2 \Sigma (X^2) - N (\Sigma X)^2}{(N - 1) (\Sigma X)^2}$$

$$\therefore \quad CV = \sqrt{CV^2}$$

CV is printed.

3. Arithmetic mean (X BAR)

Used with arithmetic normal, extreme value, gamma, etc., distributions; assumes no outliers in the sample size, N.

$$\overline{X} = \frac{\Sigma X}{N}$$

X BAR is printed.

4. Log to base e of geometric mean (LN G)

Used with log normal, log extreme value, gamma, etc., distributions; outliers may or may not be present--in general none should be present.

$$\text{Log}_e G = \frac{\Sigma \log_e X_i}{N}$$

LN G is printed.

5. Geometric mean (G)

Used with log normal, log extreme value, gamma, etc., distributions; assumes no outliers in the sample size, N.

$$G = e^{(\log_e G)}$$

G is printed.

6. Ratio of $\overline{X}$ to G

Used in maximum-likelihood solutions of log normal, log extreme value, gamma, etc., distributions; assumes no outliers in the sample size, N.

$$\overline{X}/G = \frac{\frac{\Sigma X}{N}}{e^{(\log_e G)}}$$

RATIO X/G is printed for $\overline{X}/G$.

7. Coefficient of variation (maximum likelihood) (CV*)

Used if the coefficient of variation is larger than 1/3. Used with arithmetic normal, log normal, extreme value, log extreme value, gamma, etc., distributions; assumes no outliers in the sample size, N.

$$CV^{*2} = [\ (\bar{X}/G)^2 - 1\ ]$$

$$\therefore\ CV^* = \sqrt{CV^{*2}}$$

CV* is printed.

8. Gamma-shape parameter (γ)

Used in two- and three-parameter gamma distributions and in items 9 and 10.

$$Y = \mathrm{Log}_e(\bar{X}/G)$$

(a) If $0 \le Y \le 0.5772$

$$\gamma = Y^{-1}(0.5000876 + 0.1648852Y - 0.0544274Y^2)$$

(b) If $0.5772 \le Y \le 17.0$

$$\gamma = \frac{8.898919 + 9.059950Y + 0.9775373Y^2}{Y(17.79728 + 11.968477Y + Y^2)}$$

Values of Y and GAMMA are printed. If $Y > 17.0$, the remaining calculations for the respective set are not made.

9. LN S.D.

Used if a biased estimate of the log standard deviation by the maximum-likelihood method is needed; assumes no outliers in the sample size, N.

$$\text{LN S.D.} = \sqrt{2Y}$$

LN S.D. is printed.

10. LN S.D.*

Used if an unbiased estimate of the log standard deviation by the maximum-likelihood method is needed; assumes no outliers in the sample size, N.

$$\text{LN S.D.*} = \sqrt{2Y\left(\frac{N}{N-1}\right)}$$

LN S.D.* is printed.

11. LN S.D.**

Used if an unbiased estimate of the log standard deviation by the method of moments is needed, i.e., log normal distribution; assumes no outliers in the sample size, N. The solution is obtained as in item 2.

$$\text{LN S.D.**} = CV_z\,|\text{LN G}|$$

where $Z = \log_e X_i$

LN S.D.** is printed, but the definition is not printed on the computer print-out sheets. See item 18.

12. Square root of gamma (SQR GAMMA)

Used in items 15, 16, and 17.

$$\text{SQR GAMMA} = \sqrt{Y}$$

SQR GAMMA is printed.

13. Scale parameter (BETA)

Used in item 15.

$$B = (\bar{X}/Y)$$

BETA is printed. BETA is calculated in the original units. If the drainage area is not zero, BETA is coded as BETA*, inches.

14. Scale parameter converted to inches (BETA*)

$$B^* = [\ (D)\ (0.037190083)\ (B)\ ]/M$$

where D = duration in days

M = drainage area in square miles

if M = 0, B* = B

B* is in inches of depth and is printed as BETA*.

15. BETA times SQR GAMMA, the standard deviation in the original units

$$B * S(GA) = B\sqrt{\gamma}$$

B * S(GA) is printed.

16. BETA* times SQR GAMMA, the biased standard deviation in inches of depth

$$B^* (S(GA) = (B^*)\sqrt{\gamma}$$

B* (S(GA) is printed.

17. U(P,I') times BETA* times SQR GAMMA

$$U(B^*(S(GA) = (U) \quad (B^*) \quad (\sqrt{\gamma})$$

where U= Value of f(I',P)

P= $(\gamma - 1)$

If P is between two levels of the shape parameter $(\gamma - 1)$, the P value for selected probabilities of I' (greater than I' is a selected probability level) is determined by linear interpolation.

See tables 1 and 2 for I' = 0.0; 0.2; 1; 2; 4; 10; 20; 50; 80; 90; and 99 percent (greater than).

Table 1 is used if P = −0.95(0.05)4 (pp. 12-17).
Table 2 is used if P = −0.05(0.5)74(1)164 (pp. 18-30).
Table 3 supplements table 1 (pp. 31-41).

The computer program uses an abbreviated table that includes all of table 1 and values for P = 4.5(0.5)38(1)50 from table 2. If P > 50 (or GAMMA > 51), the log normal is computed. See items 11 and 18.

U(B*(S(GA) is printed for the 11 computed points listed.

18. Log-normal solution (calculated only if GAMMA > 51.0)

$$X_i = [\ (e(\log_e G \pm K_n S_{\log_e} X)\ )\ \ (D)\ (0.037190083)\ ]/M$$

$$(CV_z)^2 = \frac{N^2\Sigma(Z_i{}^2) - N(\Sigma Z_i)^2}{(N-1)\ \ (\Sigma Z_i)^2}$$

where M = drainage area in square miles

D = duration in days

K_n = reduced variate for selected probability levels (item 19)

$Z_i = \log_e(X_i)$ is the log to base e of the transformed variate

$S_{\log_e}$ = log standard deviation or LN S.D.**

$(CV_z)^2$ is the unbiased coefficient of variation of the log transformed variate and is not printed. See item 11.

19. Other cumulative probability distributions

Reduced variates for selected distributions for given return periods

Return period	†Probability	y value	K_g value	K_n value
1.01	99	−1.52718	−1.6408	−2.3263
1.05	95	−1.09719	−1.3055	−1.6449
1.11	90	−0.83403	−1.1003	−1.2816
1.25	80	−0.47588	−0.8211	−0.8416
2	50	0.36651	−0.1643	0.0000
5	20	1.49994	0.7194	0.8416
10	10	2.25037	1.3045	1.2816
25	4	3.19853	2.0438	1.7507
50	2	3.90194	2.5923	2.0537
100	1	4.60015	3.1367	2.3263
500	0.2	6.21361	4.3947	2.8782
10^5	0.001	11.51292	8.5265	4.2649*
PM	0.00	21.87455	15.82576	5.250**
				6.015

* Not used in this program.
† Probability (percentage greater than).
** Seven digits +5 considered for probability; this is a graphic relationship.

Other sources give these reduced variate values different magnitudes. For seven 9's and a 5, 5.0400 to 5.3270, 5.250 is used as a compromise. For nine 9's and a 5, 5.485 to 6.110, 6.015 is used as a compromise since from a graphic plotting 5.250 and 6.015 are consistent.

The return period (T) is defined as

$$T = \frac{1}{I'}$$

where I' = the probability (greater than)

For the extreme value theory, y value

$$y = - \ell n \ (- \ell n \ I)$$

where I = the probability (less than)

ℓn = the natural logarithm

The equation for X_i computed for selected y values (y is a function of the return period)

$$X_i = u + (1/a) \ y$$

where u = the mode

$(1/a)$ = the logarithmic rate of increase (slope)

y = the reduced variate for selected probabilities

or for the log extreme value distribution

$$X_i = \log^{-1} [\ u_{\ell g} + (1/a)_{\ell g} \ y \ ]$$

or in terms of K_g values

$$X_i = \overline{X} \pm K_g \ S_x$$

where $\overline{X}$ = the arithmetic mean, item 3

K_g = the Gumbel reduced variate for extreme value distribution

S_x = the standard deviation in the original units, which can be calculated from item 2 or 7, depending on the size of the coefficient of variation

$S_x = CV \ \overline{X}$ or $CV^* \ \overline{X}$

and in terms of the log extreme value distribution

$$X_i = \log^{-1} [\ \overline{X}_{\ell g} \pm K_g \ S_{x\ell g}]$$

where $\overline{X}_{\ell g}$ = item 4 converted to log base 10

$S_{x\ell g}$ = item 9, 10, or 11 converted to log base 10

K_n value is used with the normal and log normal distributions.

For the normal

$$X_i = \bar{X} \pm K_n S_x$$

For the log normal

$$X_i = \log^{-1} (\bar{X}_{\ell g} \pm K_n S_{x\ell g})$$

Both K_g and K_n assume population limitations where $N = \infty$.

Sample distributions of K_g and K_n can be considered if needed.

E. Preparation of input data: Data must be punched on 80-column cards (only 79 columns are used in this program) in the exact layout specified on the multiple-card layout form. Columns 1 and 2 are used to identify each line of data arranged from largest to smallest (YR on the print-out exhibit, pp. 91-93). Identification can range from 00 to 99. There are 10 fields or columns of input data--7 fields of 8 digits and 3 fields of 7 digits. Column 80 was not used in this version. It was reserved for a binary code for the IBM-7090 computer program, which preceded this IBM-7074 program.

F. Header card or parameter card: Data must be punched on 80-column cards in the exact layout specified on the multiple-card layout form. Columns 1 through 10 are for station identification. Columns 11 through 20 are for drainage area (square miles). The period of record is always equal to the total or set 1 and must be coded as 001 in columns 21 through 23 to total N in columns 24 through 26. Sets 2 through 10 can be any sequence of numbers from 001 to N or parts thereof. It is possible to use all columns from 21 through 80 if 10 sets of computations are desired. If more than 10 sets are needed, a new station is designated.

G. End-of-file card: All 9's must be punched in columns 1 through 30 on an 80-column card as shown in the layout on the multiple-card layout form.

H. Data plotter preparation: During the processing of each set or subset, the values of CAPX(i) (conversion of mean discharge to inches) are converted to $\log_{10}$ and written on tape unit 20 to be used as input to program 0911, which prepares the values for use with the automatic data plotter. If GAMMA $\leq$ 51.0, the values of UB* $\sqrt{\gamma}$ are converted to $\log_{10}$ and written immediately after the CAPX(i) values. If GAMMA is $>$ 51.0, the log normal solutions for X_i are converted to log 10 and written out.

The ordinate ranges from a lower limit of 10^{-4} = 0.0 or 0.0001 units to no set upper limit. The abscissa is the normal reduced variate (K_n) where a lower limit of -4.0000 = 0.0 and +6.0000 = 0.9999 or 1.0. Plotting of the observed ordered data is based on normal order statistics for the abscissa (K_n) values. They can be plotted in line or dot mode. The 11 computed points are given in items 17, 18 and 19 of D. The ordinate is the sum of the log to base 10 of the observed or computed data and +4.000000, which is then multiplied by 0.1. A scale range must be selected manually for the data plotted from the ADP print-out. See programs 0910 and 0911 in the exhibits.

Print-outs of tables 1, 2, and 3 and the different programs follow.

Form SRS - DP - 102
(12 - 26 - 62)

STATISTICAL REPORTING SERVICE

USDA- SRS

MULTIPLE-CARD LAYOUT FORM

Agency SCS Division ENG-CTU

Application Hydrology Study by Elgin G. Fry Date Sept.1963 Job No. 920603-0010 Sheet No. 1 of 1

Header Card

Note 1: Assumed decimal location in drainage area is ignored if decimal is punched in card.
Note 2: Set specifications not used should be left blank.

Field	Card columns
Station Ident-ification	1–10
Drainage Area	11–20
Total Set=1: Always 001	21–23
Total Set=1: Total No. of Cards	24–26
Set 2: Beginning Card	27–29
Set 2: Ending Card	30–32
Set 3: Beginning Card	33–35
Set 3: Ending Card	36–38
Set 4: Beginning Card	39–41
Set 4: Ending Card	42–44
Set 5: Beginning Card	45–47
Set 5: Ending Card	48–50
Set 6: Beginning Card	51–53
Set 6: Ending Card	54–56
Set 7: Beginning Card	57–59
Set 7: Ending Card	60–62
Set 8: Beginning Card	63–65
Set 8: Ending Card	66–68
Set 9: Beginning Card	69–71
Set 9: Ending Card	72–74
Set 10: Beginning Card	75–77
Set 10: Ending Card	78–80

Data Cards

Note: Assumed decimal locations are ignored if decimals are punched in the fields of each card.

Field	Card columns
Identification	1–2
Field 1	3–10
Field 2	11–18
Field 3	19–26
Field 4	27–34
Field 5	35–42
Field 6	43–50
Field 7	51–58
Field 8	59–65
Field 9	66–72
Field 10	73–79
Not Used	80

End of File Card

All 9's (columns 1–30)

Table 1.--Percentage points of incomplete gamma-function ratio, I' (U,P)[1/]

P = −0.95 (0.05)4

All this table (5 pp.) is stored in the computer. The values in the body of the table are the values of U that correspond to these values of P (reading across, then down) for I' = 99.0, 90.0, 80.0, 50.0, 20.0, 10.0, 4.0, 2.0, 1.0, 0.2 and 0.0 percent chance (actually 0.0000000005). The values for I' = 0.0 are accurate to only one decimal place; the others are accurate to within a unit in the last place given (the sixth significant digit).

Example:	Given $\gamma = 0.25$	$P = \gamma - 1 = -0.75$
	50.0 percent U value is	0.873476E −01 or 0.0873476 (six significant digits)
	0.0 percent U value is	0.359000E 02 or 35.9 (one decimal accuracy)

[1/] After Harter, H. L. More tables of the incomplete gamma-function ratio and of percentage points of the chi-square distribution. U.S. Air Force Aerospace Res. Lab. Tech. Rpt. 64-123. 92 pp. 1964. (For sale Office of Technical Services, U.S. Dept. Commerce. $2.25.)

PERCENTAGE POINTS OF INCOMPLETE GAMMA-FUNCTION RATIO, I'(U,P)

P=-.95(.05)0

99.0	0.261380E-39	0.192047E-19	0.755021E-13	0.145914E-09	0.134994E-07
90.0	0.261380E-19	0.192047E-09	0.350450E-06	0.145915E-04	0.135001E-03
80.0	0.274077E-13	0.196656E-06	0.356039E-04	0.467007E-03	0.216177E-02
50.0	0.249271E-05	0.187647E-02	0.160982E-01	0.463902E-01	0.873476E-01
20.0	0.303300E-01	0.219430E-00	0.421605E-00	0.589301E 00	0.726170E 00
10.0	0.341301E-00	0.841655E 00	0.114846E 01	0.135260E 01	0.150078E 01
4.0	0.157476E 01	0.221602E 01	0.248764E 01	0.263912E 01	0.273786E 01
2.0	0.305448E 01	0.353869E 01	0.368397E 01	0.374415E 01	0.377404E 01
1.0	0.486402E 01	0.502321E 01	0.498477E 01	0.492450E 01	0.486777E 01
0.2	0.986288E 01	0.886729E 01	0.826507E 01	0.785450E 01	0.755305E 01
0.0	0.706000E 02	0.525000E 02	0.443000E 02	0.393000E 02	0.359000E 02
99.0	0.274267E-06	0.234793E-05	0.117248E-04	0.409048E-04	0.111078E-03
90.0	0.591038E-03	0.169102E-02	0.371390E-02	0.684484E-02	0.111658E-01
80.0	0.597080E-02	0.123099E-01	0.211750E-01	0.323160E-01	0.453855E-01
50.0	0.133519E-00	0.181488E-00	0.229389E-00	0.276271E-00	0.321689E-00
20.0	0.839976E 00	0.936752E 00	0.102074E 01	0.109490E 01	0.116133E 01
10.0	0.161544E 01	0.170839E 01	0.178644E 01	0.185377E 01	0.191311E 01
4.0	0.280915E 01	0.286450E 01	0.290984E 01	0.294850E 01	0.298250E 01
2.0	0.379127E 01	0.380278E 01	0.381167E 01	0.381943E 01	0.382679E 01
1.0	0.481888E 01	0.477780E 01	0.474357E 01	0.471514E 01	0.469158E 01
0.2	0.732079E 01	0.713573E 01	0.698459E 01	0.685880E 01	0.675254E 01
0.0	0.334000E 02	0.314000E 02	0.298000E 02	0.285000E 02	0.274000E 02
99.0	0.251469E-03	0.496820E-03	0.884094E-03	0.144936E-02	0.222540E-02
90.0	0.166753E-01	0.233159E-01	0.309978E-01	0.396164E-01	0.490638E-01
80.0	0.600267E-01	0.759148E-01	0.927714E-01	0.110366E-00	0.128510E-00
50.0	0.365465E-00	0.407569E-00	0.448043E-00	0.486964E-00	0.524427E 00
20.0	0.122158E 01	0.127678E 01	0.132779E 01	0.137528E 01	0.141977E 01
10.0	0.196629E 01	0.201460E 01	0.205900E 01	0.210017E 01	0.213866E 01
4.0	0.301310E 01	0.304116E 01	0.306726E 01	0.309180E 01	0.311509E 01
2.0	0.383413E 01	0.384166E 01	0.384945E 01	0.385755E 01	0.386595E 01
1.0	0.467211E 01	0.465609E 01	0.464299E 01	0.463239E 01	0.462394E 01
0.2	0.666171E 01	0.658329E 01	0.651504E 01	0.645524E 01	0.640255E 01
0.0	0.264000E 02	0.256000E 02	0.249000E 02	0.242000E 02	0.237000E 02
99.0	0.324015E-02	0.451599E-02	0.606960E-02	0.791225E-02	0.100503E-01
90.0	0.592355E-01	0.700344E-01	0.813725E-01	0.931710E-01	0.105361E-00
80.0	0.147053E-00	0.165875E-00	0.184879E-00	0.203988E-00	0.223144E-00
50.0	0.560528E 00	0.595363E 00	0.629022E 00	0.661591E 00	0.693147E 00
20.0	0.146169E 01	0.150135E 01	0.153906E 01	0.157502E 01	0.160944E 01
10.0	0.217487E 01	0.220913E 01	0.224170E 01	0.227279E 01	0.230259E 01
4.0	0.313735E 01	0.315874E 01	0.317939E 01	0.319941E 01	0.321888E 01
2.0	0.387465E 01	0.388364E 01	0.389287E 01	0.390234E 01	0.391202E 01
1.0	0.461735E 01	0.461236E 01	0.460878E 01	0.460643E 01	0.460517E 01
0.2	0.635589E 01	0.631441E 01	0.627740E 01	0.624430E 01	0.621461E 01
0.0	0.231000E 02	0.227000E 02	0.222000E 02	0.218000E 02	0.215000E 02

PERCENTAGE POINTS OF INCOMPLETE GAMMA-FUNCTION RATIO, I'(U,P)

P=0.05(.05)1

99.0	0.124860E-01	0.152180E-01	0.182421E-01	0.215517E-01	0.251388E-01
90.0	0.117880E-00	0.130676E-00	0.143703E-00	0.156921E-00	0.170294E-00
80.0	0.242296E-00	0.261409E-00	0.280451E-00	0.299400E-00	0.318237E-00
50.0	0.723761E 00	0.753498E 00	0.782417E 00	0.810571E 00	0.838010E 00
20.0	0.164247E 01	0.167426E 01	0.170491E 01	0.173454E 01	0.176322E 01
10.0	0.233122E 01	0.235882E 01	0.238549E 01	0.241131E 01	0.243637E 01
4.0	0.323785E 01	0.325639E 01	0.327453E 01	0.329232E 01	0.330979E 01
2.0	0.392189E 01	0.393192E 01	0.394210E 01	0.395240E 01	0.396282E 01
1.0	0.460487E 01	0.460542E 01	0.460674E 01	0.460873E 01	0.461133E 01
0.2	0.618794E 01	0.616393E 01	0.614232E 01	0.612282E 01	0.610525E 01
0.0	0.211000E 02	0.208000E 02	0.205000E 02	0.203000E 02	0.200000E 02
99.0	0.289938E-01	0.331065E-01	0.374659E-01	0.420608E-01	0.468799E-01
90.0	0.183793E-00	0.197391E-00	0.211066E-00	0.224798E-00	0.238570E-00
80.0	0.336949E-00	0.355524E-00	0.373954E-00	0.392235E-00	0.410361E-00
50.0	0.864778E 00	0.890916E 00	0.916461E 00	0.941447E 00	0.965905E 00
20.0	0.179104E 01	0.181807E 01	0.184436E 01	0.186996E 01	0.189494E 01
10.0	0.246072E 01	0.248442E 01	0.250753E 01	0.253008E 01	0.255212E 01
4.0	0.332695E 01	0.334384E 01	0.336047E 01	0.337686E 01	0.339302E 01
2.0	0.397333E 01	0.398393E 01	0.399459E 01	0.400532E 01	0.401611E 01
1.0	0.461447E 01	0.461811E 01	0.462219E 01	0.462668E 01	0.463152E 01
0.2	0.608940E 01	0.607510E 01	0.606223E 01	0.605065E 01	0.604025E 01
0.0	0.198000E 02	0.195000E 02	0.193000E 02	0.191000E 02	0.189000E 02
99.0	0.519118E-01	0.571454E-01	0.625698E-01	0.681744E-01	0.739490E-01
90.0-	0.252367E-00	0.266177E-00	0.279989E-00	0.293792E-00	0.307579E-00
80.0	0.428329E-00	0.446139E-00	0.463788E-00	0.481279E-00	0.498610E-00
50.0	0.989863E 00	0.101335E 01	0.103639E 01	0.105900E 01	0.108120E 01
20.0	0.191932E 01	0.194314E 01	0.196644E 01	0.198926E 01	0.201161E 01
10.0	0.257368E 01	0.259479E 01	0.261549E 01	0.263579E 01	0.265572E 01
4.0	0.340897E 01	0.342472E 01	0.344028E 01	0.345566E 01	0.347087E 01
2.0	0.402693E 01	0.403779E 01	0.404868E 01	0.405959E 01	0.407051E 01
1.0	0.463670E 01	0.464217E 01	0.464792E 01	0.465392E 01	0.466014E 01
0.2	0.603092E 01	0.602258E 01	0.601516E 01	0.600857E 01	0.600276E 01
0.0	0.188000E 02	0.186000E 02	0.184000E 02	0.183000E 02	0.181000E 02
99.0	0.798839E-01	0.859696E-01	0.921972E-01	0.985580E-01	0.105044E-00
90.0	0.321343E-00	0.335076E-00	0.348775E-00	0.362433E-00	0.376048E-00
80.0	0.515783E 00	0.532800E 00	0.549662E 00	0.566372E 00	0.582930E 00
50.0	0.110302E 01	0.112447E 01	0.114557E 01	0.116633E 01	0.118677E 01
20.0	0.203353E 01	0.205504E 01	0.207615E 01	0.209690E 01	0.211730E 01
10.0	0.267529E 01	0.269454E 01	0.271347E 01	0.273210E 01	0.275045E 01
4.0	0.348591E 01	0.350079E 01	0.351552E 01	0.353011E 01	0.354456E 01
2.0	0.408144E 01	0.409239E 01	0.410333E 01	0.411427E 01	0.412521E 01
1.0	0.466657E 01	0.467319E 01	0.467998E 01	0.468693E 01	0.469402E 01
0.2	0.599766E 01	0.599323E 01	0.598941E 01	0.598617E 01	0.598345E 01
0.0	0.180000E 02	0.179000E 02	0.177000E 02	0.176000E 02	0.175000E 02

PERCENTAGE POINTS OF INCOMPLETE GAMMA-FUNCTION RATIO, I'(U,P)
P=1.05(.05)2

99.0	0.111648E-00	0.118361E-00	0.125178E-00	0.132092E-00	0.139097E-00
90.0	0.389615E-00	0.403132E-00	0.416596E-00	0.430005E-00	0.443357E-00
80.0	0.599341E 00	0.615606E 00	0.631727E 00	0.647708E 00	0.663550E 00
50.0	0.120690E 01	0.122674E 01	0.124629E 01	0.126557E 01	0.128458E 01
20.0	0.213736E 01	0.215710E 01	0.217653E 01	0.219568E 01	0.221454E 01
10.0	0.276852E 01	0.278634E 01	0.280391E 01	0.282125E 01	0.283835E 01
4.0	0.355887E 01	0.357305E 01	0.358710E 01	0.360103E 01	0.361485E 01
2.0	0.413613E 01	0.414705E 01	0.415795E 01	0.416884E 01	0.417971E 01
1.0	0.470125E 01	0.470860E 01	0.471606E 01	0.472362E 01	0.473128E 01
0.2	0.598124E 01	0.597949E 01	0.597818E 01	0.597727E 01	0.597674E 01
0.0	0.174000E 02	0.173000E 02	0.172000E 02	0.171000E 02	0.170000E 02
99.0	0.146186E-00	0.153354E-00	0.160597E-00	0.167908E-00	0.175284E-00
90.0	0.456651E-00	0.469886E-00	0.483060E-00	0.496173E-00	0.509224E 00
80.0	0.679256E 00	0.694829E 00	0.710272E 00	0.725586E 00	0.740774E 00
50.0	0.130335E 01	0.132187E 01	0.134015E 01	0.135821E 01	0.137605E 01
20.0	0.223314E 01	0.225148E 01	0.226958E 01	0.228744E 01	0.230507E 01
10.0	0.285524E 01	0.287192E 01	0.288840E 01	0.290469E 01	0.292079E 01
4.0	0.362855E 01	0.364213E 01	0.365561E 01	0.366899E 01	0.368226E 01
2.0	0.419056E 01	0.420139E 01	0.421219E 01	0.422297E 01	0.423373E 01
1.0	0.473902E 01	0.474684E 01	0.475473E 01	0.476268E 01	0.477070E 01
0.2	0.597657E 01	0.597673E 01	0.597721E 01	0.597799E 01	0.597904E 01
0.0	0.169000E 02	0.168000E 02	0.167000E 02	0.166000E 02	0.165000E 02
99.0	0.182721E-00	0.190213E-00	0.197758E-00	0.205351E-00	0.212990E-00
90.0	0.522213E 00	0.535138E 00	0.548001E 00	0.560801E 00	0.573537E 00
80.0	0.755840E 00	0.770784E 00	0.785609E 00	0.800319E 00	0.814914E 00
50.0	0.139368E 01	0.141111E 01	0.142833E 01	0.144537E 01	0.146222E 01
20.0	0.232248E 01	0.233969E 01	0.235668E 01	0.237348E 01	0.239009E 01
10.0	0.293671E 01	0.295246E 01	0.296804E 01	0.298346E 01	0.299872E 01
4.0	0.369543E 01	0.370851E 01	0.372149E 01	0.373438E 01	0.374717E 01
2.0	0.424446E 01	0.425516E 01	0.426583E 01	0.427648E 01	0.428710E 01
1.0	0.477877E 01	0.478689E 01	0.479506E 01	0.480326E 01	0.481151E 01
0.2	0.598036E 01	0.598192E 01	0.598372E 01	0.598574E 01	0.598798E 01
0.0	0.165000E 02	0.164000E 02	0.163000E 02	0.163000E 02	0.162000E 02
99.0	0.220670E-00	0.228389E-00	0.236144E-00	0.243932E-00	0.251751E-00
90.0	0.586211E 00	0.598821E 00	0.611369E 00	0.623855E 00	0.636278E 00
80.0	0.829398E 00	0.843772E 00	0.858039E 00	0.872200E 00	0.886258E 00
50.0	0.147889E 01	0.149538E 01	0.151171E 01	0.152787E 01	0.154387E 01
20.0	0.240652E 01	0.242277E 01	0.243884E 01	0.245475E 01	0.247050E 01
10.0	0.301383E 01	0.302879E 01	0.304361E 01	0.305830E 01	0.307284E 01
4.0	0.375988E 01	0.377251E 01	0.378505E 01	0.379750E 01	0.380988E 01
2.0	0.429768E 01	0.430824E 01	0.431876E 01	0.432925E 01	0.433971E 01
1.0	0.481979E 01	0.482810E 01	0.483643E 01	0.484479E 01	0.485318E 01
0.2	0.599040E 01	0.599302E 01	0.599581E 01	0.599877E 01	0.600190E 01
0.0	0.161000E 02	0.161000E 02	0.160000E 02	0.159000E 02	0.159000E 02

PERCENTAGE POINTS OF INCOMPLETE GAMMA-FUNCTION RATIO, $I'(U,P)$ 4 of 5

P=2.05(.05)3

99.0	0.259598E-00	0.267470E-00	0.275367E-00	0.283285E-00	0.291223E-00
90.0	0.648639E 00	0.660939E 00	0.673178E 00	0.685356E 00	0.697474E 00
80.0	0.900215E 00	0.914072E 00	0.927831E 00	0.941494E 00	0.955064E 00
50.0	0.155972E 01	0.157541E 01	0.159096E 01	0.160636E 01	0.162163E 01
20.0	0.248609E 01	0.250153E 01	0.251682E 01	0.253196E 01	0.254697E 01
10.0	0.308726E 01	0.310155E 01	0.311572E 01	0.312976E 01	0.314369E 01
4.0	0.382218E 01	0.383440E 01	0.384654E 01	0.385861E 01	0.387061E 01
2.0	0.435014E 01	0.436054E 01	0.437090E 01	0.438123E 01	0.439153E 01
1.0	0.486158E 01	0.487000E 01	0.487843E 01	0.488688E 01	0.489534E 01
0.2	0.600517E 01	0.600858E 01	0.601213E 01	0.601581E 01	0.601962E 01
0.0	0.158000E 02	0.158000E 02	0.157000E 02	0.157000E 02	0.156000E 02
99.0	0.299179E-00	0.307151E-00	0.315138E-00	0.323137E-00	0.331148E-00
90.0	0.709532E 00	0.721532E 00	0.733472E 00	0.745355E 00	0.757180E 00
80.0	0.968541E 00	0.981927E 00	0.995224E 00	0.100843E 01	0.102156E 01
50.0	0.163676E 01	0.165176E 01	0.166663E 01	0.168137E 01	0.169599E 01
20.0	0.256184E 01	0.257658E 01	0.259118E 01	0.260567E 01	0.262003E 01
10.0	0.315751E 01	0.317121E 01	0.318481E 01	0.319830E 01	0.321169E 01
4.0	0.388254E 01	0.389439E 01	0.390618E 01	0.391790E 01	0.392955E 01
2.0	0.440180E 01	0.441203E 01	0.442223E 01	0.443240E 01	0.444253E 01
1.0	0.490380E 01	0.491228E 01	0.492076E 01	0.492925E 01	0.493773E 01
0.2	0.602354E 01	0.602757E 01	0.603171E 01	0.603595E 01	0.604028E 01
0.0	0.156000E 02	0.155000E 02	0.155000E 02	0.154000E 02	0.154000E 02
99.0	0.339169E-00	0.347200E-00	0.355237E-00	0.363281E-00	0.371331E-00
90.0	0.768948E 00	0.780659E 00	0.792315E 00	0.803915E 00	0.815460E 00
80.0	0.103460E 01	0.104756E 01	0.106043E 01	0.107323E 01	0.108594E 01
50.0	0.171049E 01	0.172487E 01	0.173914E 01	0.175330E 01	0.176735E 01
20.0	0.263427E 01	0.264840E 01	0.266241E 01	0.267631E 01	0.269010E 01
10.0	0.322498E 01	0.323816E 01	0.325126E 01	0.326426E 01	0.327716E 01
4.0	0.394114E 01	0.395267E 01	0.396413E 01	0.397553E 01	0.398687E 01
2.0	0.445263E 01	0.446270E 01	0.447273E 01	0.448273E 01	0.449270E 01
1.0	0.494622E 01	0.495472E 01	0.496321E 01	0.497170E 01	0.498019E 01
0.2	0.604471E 01	0.604922E 01	0.605382E 01	0.605850E 01	0.606325E 01
0.0	0.153000E 02	0.153000E 02	0.153000E 02	0.152000E 02	0.152000E 02
99.0	0.379385E-00	0.387442E-00	0.395501E-00	0.403563E-00	0.411624E-00
90.0	0.826951E 00	0.838389E 00	0.849773E 00	0.861105E 00	0.872385E 00
80.0	0.109858E 01	0.111115E 01	0.112364E 01	0.113605E 01	0.114839E 01
50.0	0.178129E 01	0.179512E 01	0.180886E 01	0.182249E 01	0.183603E 01
20.0	0.270379E 01	0.271737E 01	0.273085E 01	0.274424E 01	0.275752E 01
10.0	0.328998E 01	0.330271E 01	0.331535E 01	0.332791E 01	0.334039E 01
4.0	0.399815E 01	0.400937E 01	0.402054E 01	0.403164E 01	0.404269E 01
2.0	0.450264E 01	0.451254E 01	0.452241E 01	0.453225E 01	0.454206E 01
1.0	0.498867E 01	0.499715E 01	0.500563E 01	0.501410E 01	0.502256E 01
0.2	0.606807E 01	0.607296E 01	0.607792E 01	0.608294E 01	0.608802E 01
0.0	0.152000E 02	0.151000E 02	0.151000E 02	0.150000E 02	0.150000E 02

PERCENTAGE POINTS OF INCOMPLETE GAMMA-FUNCTION RATIO, I'(U,P)

P=3.05(.05)4

99.0	0.419686E-00	0.427747E-00	0.435806E-00	0.443863E-00	0.451917E-00
90.0	0.883613E 00	0.894791E 00	0.905918E 00	0.916995E 00	0.928024E 00
80.0	0.116067E 01	0.117287E 01	0.118500E 01	0.119707E 01	0.120906E 01
50.0	0.184947E 01	0.186282E 01	0.187607E 01	0.188924E 01	0.190231E 01
20.0	0.277072E 01	0.278382E 01	0.279682E 01	0.280974E 01	0.282258E 01
10.0	0.335279E 01	0.336511E 01	0.337735E 01	0.338951E 01	0.340160E 01
4.0	0.405369E 01	0.406463E 01	0.407552E 01	0.408636E 01	0.409714E 01
2.0	0.455183E 01	0.456158E 01	0.457129E 01	0.458097E 01	0.459061E 01
1.0	0.503102E 01	0.503946E 01	0.504791E 01	0.505634E 01	0.506476E 01
0.2	0.609316E 01	0.609835E 01	0.610359E 01	0.610889E 01	0.611422E 01
0.0	0.150000E 02	0.149000E 02	0.149000E 02	0.149000E 02	0.149000E 02
99.0	0.459967E-00	0.468014E-00	0.476055E-00	0.484092E-00	0.492123E-00
90.0	0.939003E 00	0.949934E 00	0.960818E 00	0.971655E 00	0.982444E 00
80.0	0.122100E 01	0.123286E 01	0.124467E 01	0.125641E 01	0.126809E 01
50.0	0.191530E 01	0.192821E 01	0.194103E 01	0.195377E 01	0.196642E 01
20.0	0.283533E 01	0.284799E 01	0.286057E 01	0.287308E 01	0.288550E 01
10.0	0.341361E 01	0.342556E 01	0.343743E 01	0.344923E 01	0.346097E 01
4.0	0.410787E 01	0.411856E 01	0.412919E 01	0.413978E 01	0.415031E 01
2.0	0.460023E 01	0.460982E 01	0.461937E 01	0.462889E 01	0.463839E 01
1.0	0.507318E 01	0.508158E 01	0.508997E 01	0.509835E 01	0.510672E 01
0.2	0.611961E 01	0.612504E 01	0.613051E 01	0.613601E 01	0.614156E 01
0.0	0.148000E 02	0.148000E 02	0.148000E 02	0.147000E 02	0.147000E 02
99.0	0.500148E 00	0.508166E 00	0.516178E 00	0.524182E 00	0.532178E 00
90.0	0.993188E 00	0.100389E 01	0.101454E 01	0.102515E 01	0.103571E 01
80.0	0.127971E 01	0.129127E 01	0.130277E 01	0.131421E 01	0.132560E 01
50.0	0.197900E 01	0.199151E 01	0.200393E 01	0.201628E 01	0.202856E 01
20.0	0.289785E 01	0.291012E 01	0.292232E 01	0.293444E 01	0.294649E 01
10.0	0.347264E 01	0.348424E 01	0.349578E 01	0.350726E 01	0.351867E 01
4.0	0.416080E 01	0.417124E 01	0.418164E 01	0.419199E 01	0.420229E 01
2.0	0.464785E 01	0.465728E 01	0.466669E 01	0.467606E 01	0.468541E 01
1.0	0.511508E 01	0.512343E 01	0.513177E 01	0.514009E 01	0.514840E 01
0.2	0.614714E 01	0.615276E 01	0.615841E 01	0.616409E 01	0.616980E 01
0.0	0.147000E 02	0.147000E 02	0.146000E 02	0.146000E 02	0.146000E 02
99.0	0.540167E 00	0.548147E 00	0.556118E 00	0.564080E 00	0.572033E 00
90.0	0.104623E 01	0.105671E 01	0.106714E 01	0.107754E 01	0.108789E 01
80.0	0.133692E 01	0.134819E 01	0.135941E 01	0.137057E 01	0.138168E 01
50.0	0.204077E 01	0.205290E 01	0.206497E 01	0.207696E 01	0.208889E 01
20.0	0.295847E 01	0.297038E 01	0.298223E 01	0.299400E 01	0.300571E 01
10.0	0.353003E 01	0.354132E 01	0.355255E 01	0.356372E 01	0.357484E 01
4.0	0.421256E 01	0.422277E 01	0.423295E 01	0.424308E 01	0.425317E 01
2.0	0.469472E 01	0.470401E 01	0.471326E 01	0.472249E 01	0.473169E 01
1.0	0.515669E 01	0.516498E 01	0.517325E 01	0.518150E 01	0.518975E 01
0.2	0.617554E 01	0.618130E 01	0.618709E 01	0.619291E 01	0.619875E 01
0.0	0.146000E 02	0.145000E 02	0.145000E 02	0.145000E 02	0.145000E 02

Table 2.--Percentage points of incomplete gamma-function ratio, I' (U,P)[1/]

P = -0.5(0.5)74(1)164

Only part of this table (12 pp.) is stored in the computer--see program No. 1319 for P = 4.5(0.5)38 and P = 39(1.0)50. Storage capacity of the present computer sets this limit. In the future, possibly all of table 2 could be used. The values in the body of the table are the values of U that correspond to these values of P (reading across, then down) for I' = 99.0, 90.0, 80.0, 50.0, 20.0, 10.0, 4.0, 2.0, 1.0, 0.2, and 0.0 percent chance (actually 0.0000000005). The values for I' = 0.0 are accurate to only one decimal place; the others are accurate to within a unit in the last place given (the sixth significant digit).

Example: Given $\gamma = 30.5$ $P = \gamma - 1 = 29.5$

50.0 percent U value is 0.546244E 01 or
5.46244 (six significant digits)

0.0 percent U value is 0.140000E 02 or
14.0 (one decimal accuracy)

[1/] After Harter, H. L. New tables of the imcomplete gamma-function ratio and of percentage points of the chi-square and beta distributions. U.S. Air Force Aerospace Res. Lab. 245 pp. (For sale by Superintendent of Documents, U.S. Government Printing Office, Washington D.C., 20402. $2.50.) Tables 1 and 2 were obtained from Harter for SCS specific needs.

PERCENTAGE POINTS OF INCOMPLETE GAMMA-FUNCTION RATIO, I'(U,P)

P=-.5(.5)9

99.0	0.111078E-03	0.100503E-01	0.468799E-01	0.105044E-00	0.175284E-00
90.0	0.111658E-01	0.105361E-00	0.238570E-00	0.376048E-00	0.509224E 00
80.0	0.453855E-01	0.223144E-00	0.410361E-00	0.582930E 00	0.740774E 00
50.0	0.321689E-00	0.693147E 00	0.965905E 00	0.118677E 01	0.137605E 01
20.0	0.116133E 01	0.160944E 01	0.189494E 01	0.211730E 01	0.230507E 01
10.0	0.191311E 01	0.230259E 01	0.255212E 01	0.275045E 01	0.292079E 01
4.0	0.298250E 01	0.321888E 01	0.339302E 01	0.354456E 01	0.368226E 01
2.0	0.382679E 01	0.391202E 01	0.401611E 01	0.412521E 01	0.423373E 01
1.0	0.469158E 01	0.460517E 01	0.463152E 01	0.469402E 01	0.477070E 01
0.2	0.675254E 01	0.621461E 01	0.604025E 01	0.598345E 01	0.597904E 01
0.0	0.274000E 02	0.215000E 02	0.189000E 02	0.175000E 02	0.165000E 02
99.0	0.251751E-00	0.331148E-00	0.411624E-00	0.492123E-00	0.572033E 00
90.0	0.636278E 00	0.757180E 00	0.872385E 00	0.982444E 00	0.108789E 01
80.0	0.886258E 00	0.102156E 01	0.114839E 01	0.126809E 01	0.138168E 01
50.0	0.154387E 01	0.169599E 01	0.183603E 01	0.196642E 01	0.208889E 01
20.0	0.247050E 01	0.262003E 01	0.275752E 01	0.288550E 01	0.300571E 01
10.0	0.307284E 01	0.321169E 01	0.334039E 01	0.346097E 01	0.357484E 01
4.0	0.380988E 01	0.392955E 01	0.404269E 01	0.415031E 01	0.425317E 01
2.0	0.433971E 01	0.444253E 01	0.454206E 01	0.463839E 01	0.473169E 01
1.0	0.485318E 01	0.493773E 01	0.502256E 01	0.510672E 01	0.518975E 01
0.2	0.600190E 01	0.604028E 01	0.608802E 01	0.614156E 01	0.619875E 01
0.0	0.159000E 02	0.154000E 02	0.150000E 02	0.147000E 02	0.145000E 02
99.0	0.651005E 00	0.728839E 00	0.805432E 00	0.880738E 00	0.954744E 00
90.0	0.118919E 01	0.128676E 01	0.138095E 01	0.147208E 01	0.156042E 01
80.0	0.148999E 01	0.159366E 01	0.169324E 01	0.178916E 01	0.188178E 01
50.0	0.220471E 01	0.231483E 01	0.242003E 01	0.252089E 01	0.261791E 01
20.0	0.311943E 01	0.322761E 01	0.333099E 01	0.343017E 01	0.352563E 01
10.0	0.368304E 01	0.378637E 01	0.388544E 01	0.398075E 01	0.407271E 01
4.0	0.435186E 01	0.444687E 01	0.453858E 01	0.462732E 01	0.471336E 01
2.0	0.482216E 01	0.490999E 01	0.499537E 01	0.507848E 01	0.515945E 01
1.0	0.527138E 01	0.535152E 01	0.543011E 01	0.550718E 01	0.558274E 01
0.2	0.625822E 01	0.631906E 01	0.638068E 01	0.644265E 01	0.650468E 01
0.0	0.143000E 02	0.141000E 02	0.140000E 02	0.139000E 02	0.138000E 02
99.0	0.102746E 01	0.109892E 01	0.116915E 01	0.123819E 01	0.130608E 01
90.0	0.164619E 01	0.172960E 01	0.181082E 01	0.189003E 01	0.196735E 01
80.0	0.197143E 01	0.205837E 01	0.214282E 01	0.222499E 01	0.230505E 01
50.0	0.271149E 01	0.280198E 01	0.288965E 01	0.297476E 01	0.305752E 01
20.0	0.361775E 01	0.370687E 01	0.379326E 01	0.387716E 01	0.395878E 01
10.0	0.416165E 01	0.424786E 01	0.433157E 01	0.441300E 01	0.449233E 01
4.0	0.479695E 01	0.487827E 01	0.495751E 01	0.503482E 01	0.511033E 01
2.0	0.523845E 01	0.531561E 01	0.539103E 01	0.546482E 01	0.553709E 01
1.0	0.565684E 01	0.572954E 01	0.580088E 01	0.587093E 01	0.593974E 01
0.2	0.656656E 01	0.662815E 01	0.668935E 01	0.675008E 01	0.681028E 01
0.0	0.137000E 02	0.137000E 02	0.136000E 02	0.136000E 02	0.135000E 02

PERCENTAGE POINTS OF INCOMPLETE GAMMA-FUNCTION RATIO, $I'(U,P)$

P=9.5(.5)19

99.0	0.137287E 01	0.143858E 01	0.150328E 01	0.156698E 01	0.162974E 01
90.0	0.204291E 01	0.211683E 01	0.218921E 01	0.226014E 01	0.232969E 01
80.0	0.238315E 01	0.245943E 01	0.253401E 01	0.260700E 01	0.267849E 01
50.0	0.313810E 01	0.321668E 01	0.329339E 01	0.336837E 01	0.344171E 01
20.0	0.403829E 01	0.411585E 01	0.419160E 01	0.426565E 01	0.433813E 01
10.0	0.456971E 01	0.464528E 01	0.471916E 01	0.479147E 01	0.486229E 01
4.0	0.518417E 01	0.525644E 01	0.532723E 01	0.539665E 01	0.546475E 01
2.0	0.560792E 01	0.567738E 01	0.574556E 01	0.581253E 01	0.587833E 01
1.0	0.600737E 01	0.607385E 01	0.613925E 01	0.620360E 01	0.626696E 01
0.2	0.686993E 01	0.692901E 01	0.698749E 01	0.704538E 01	0.710267E 01
0.0	0.135000E 02	0.135000E 02	0.135000E 02	0.134000E 02	0.134000E 02
99.0	0.169158E 01	0.175254E 01	0.181266E 01	0.187196E 01	0.193048E 01
90.0	0.239795E 01	0.246499E 01	0.253086E 01	0.259563E 01	0.265935E 01
80.0	0.274857E 01	0.281732E 01	0.288481E 01	0.295112E 01	0.301629E 01
50.0	0.351353E 01	0.358392E 01	0.365296E 01	0.372072E 01	0.378726E 01
20.0	0.440912E 01	0.447871E 01	0.454699E 01	0.461402E 01	0.467988E 01
10.0	0.493173E 01	0.499985E 01	0.506673E 01	0.513244E 01	0.519703E 01
4.0	0.553163E 01	0.559733E 01	0.566192E 01	0.572546E 01	0.578799E 01
2.0	0.594303E 01	0.600669E 01	0.606935E 01	0.613105E 01	0.619184E 01
1.0	0.632936E 01	0.639085E 01	0.645145E 01	0.651121E 01	0.657015E 01
0.2	0.715936E 01	0.721546E 01	0.727097E 01	0.732591E 01	0.738028E 01
0.0	0.134000E 02	0.134000E 02	0.134000E 02	0.134000E 02	0.134000E 02
99.0	0.198824E 01	0.204528E 01	0.210160E 01	0.215725E 01	0.221224E 01
90.0	0.272207E 01	0.278382E 01	0.284467E 01	0.290464E 01	0.296377E 01
80.0	0.308039E 01	0.314347E 01	0.320558E 01	0.326674E 01	0.332702E 01
50.0	0.385267E 01	0.391698E 01	0.398026E 01	0.404255E 01	0.410389E 01
20.0	0.474462E 01	0.480829E 01	0.487095E 01	0.493265E 01	0.499342E 01
10.0	0.526057E 01	0.532309E 01	0.538466E 01	0.544531E 01	0.550508E 01
4.0	0.584956E 01	0.591022E 01	0.597000E 01	0.602894E 01	0.608707E 01
2.0	0.625176E 01	0.631084E 01	0.636911E 01	0.642662E 01	0.648338E 01
1.0	0.662831E 01	0.668572E 01	0.674240E 01	0.679838E 01	0.685369E 01
0.2	0.743410E 01	0.748737E 01	0.754011E 01	0.759233E 01	0.764403E 01
0.0	0.134000E 02	0.134000E 02	0.134000E 02	0.135000E 02	0.135000E 02
99.0	0.226659E 01	0.232033E 01	0.237347E 01	0.242604E 01	0.247804E 01
90.0	0.302209E 01	0.307964E 01	0.313645E 01	0.319254E 01	0.324795E 01
80.0	0.338645E 01	0.344505E 01	0.350287E 01	0.355994E 01	0.361628E 01
50.0	0.416434E 01	0.422392E 01	0.428267E 01	0.434063E 01	0.439783E 01
20.0	0.505332E 01	0.511236E 01	0.517060E 01	0.522807E 01	0.528478E 01
10.0	0.556401E 01	0.562213E 01	0.567948E 01	0.573609E 01	0.579198E 01
4.0	0.614444E 01	0.620106E 01	0.625696E 01	0.631218E 01	0.636674E 01
2.0	0.653942E 01	0.659478E 01	0.664948E 01	0.670353E 01	0.675696E 01
1.0	0.690834E 01	0.696236E 01	0.701577E 01	0.706859E 01	0.712084E 01
0.2	0.769524E 01	0.774596E 01	0.779620E 01	0.784598E 01	0.789530E 01
0.0	0.135000E 02	0.135000E 02	0.135000E 02	0.135000E 02	0.135000E 02

PERCENTAGE POINTS OF INCOMPLETE GAMMA-FUNCTION RATIO, I'(U,P)

P=19.5(.5)29

99.0	0.252950E 01	0.258044E 01	0.263086E 01	0.268079E 01	0.273023E 01
90.0	0.330269E 01	0.335678E 01	0.341026E 01	0.346314E 01	0.351544E 01
80.0	0.367191E 01	0.372688E 01	0.378119E 01	0.383488E 01	0.388796E 01
50.0	0.445429E 01	0.451004E 01	0.456512E 01	0.461954E 01	0.467333E 01
20.0	0.534078E 01	0.539609E 01	0.545073E 01	0.550473E 01	0.555811E 01
10.0	0.584718E 01	0.590172E 01	0.595562E 01	0.600891E 01	0.606159E 01
4.0	0.642066E 01	0.647395E 01	0.652666E 01	0.657878E 01	0.663035E 01
2.0	0.680980E 01	0.686206E 01	0.691376E 01	0.696491E 01	0.701554E 01
1.0	0.717253E 01	0.722369E 01	0.727433E 01	0.732446E 01	0.737410E 01
0.2	0.794417E 01	0.799261E 01	0.804063E 01	0.808823E 01	0.813543E 01
0.0	0.136000E 02	0.136000E 02	0.136000E 02	0.136000E 02	0.136000E 02
99.0	0.277921E 01	0.282773E 01	0.287580E 01	0.292345E 01	0.297067E 01
90.0	0.356718E 01	0.361837E 01	0.366904E 01	0.371920E 01	0.376886E 01
80.0	0.394045E 01	0.399238E 01	0.404375E 01	0.409459E 01	0.414492E 01
50.0	0.472651E 01	0.477909E 01	0.483111E 01	0.488257E 01	0.493349E 01
20.0	0.561088E 01	0.566308E 01	0.571472E 01	0.576581E 01	0.581638E 01
10.0	0.611370E 01	0.616525E 01	0.621626E 01	0.626674E 01	0.631671E 01
4.0	0.668137E 01	0.673187E 01	0.678187E 01	0.683137E 01	0.688039E 01
2.0	0.706566E 01	0.711528E 01	0.716443E 01	0.721310E 01	0.726132E 01
1.0	0.742326E 01	0.747195E 01	0.752020E 01	0.756801E 01	0.761539E 01
0.2	0.818223E 01	0.822865E 01	0.827468E 01	0.832035E 01	0.836566E 01
0.0	0.137000E 02	0.137000E 02	0.137000E 02	0.137000E 02	0.137000E 02
99.0	0.301748E 01	0.306389E 01	0.310991E 01	0.315555E 01	0.320082E 01
90.0	0.381805E 01	0.386676E 01	0.391502E 01	0.396284E 01	0.401023E 01
80.0	0.419475E 01	0.424409E 01	0.429295E 01	0.434136E 01	0.438932E 01
50.0	0.498390E 01	0.503380E 01	0.508321E 01	0.513214E 01	0.518062E 01
20.0	0.586644E 01	0.591600E 01	0.596508E 01	0.601369E 01	0.606185E 01
10.0	0.636619E 01	0.641520E 01	0.646373E 01	0.651182E 01	0.655946E 01
4.0	0.692894E 01	0.697704E 01	0.702471E 01	0.707194E 01	0.711876E 01
2.0	0.730910E 01	0.735645E 01	0.740339E 01	0.744991E 01	0.749604E 01
1.0	0.766235E 01	0.770891E 01	0.775507E 01	0.780085E 01	0.784625E 01
0.2	0.841060E 01	0.845521E 01	0.849947E 01	0.854341E 01	0.858701E 01
0.0	0.138000E 02	0.138000E 02	0.138000E 02	0.138000E 02	0.139000E 02
99.0	0.324572E 01	0.329028E 01	0.333448E 01	0.337835E 01	0.342188E 01
90.0	0.405720E 01	0.410376E 01	0.414992E 01	0.419570E 01	0.424110E 01
80.0	0.443685E 01	0.448395E 01	0.453064E 01	0.457694E 01	0.462284E 01
50.0	0.522864E 01	0.527623E 01	0.532339E 01	0.537014E 01	0.541649E 01
20.0	0.610957E 01	0.615686E 01	0.620373E 01	0.625019E 01	0.629626E 01
10.0	0.660668E 01	0.665348E 01	0.669987E 01	0.674587E 01	0.679149E 01
4.0	0.716517E 01	0.721119E 01	0.725682E 01	0.730208E 01	0.734696E 01
2.0	0.754178E 01	0.758714E 01	0.763214E 01	0.767677E 01	0.772106E 01
1.0	0.789128E 01	0.793595E 01	0.798027E 01	0.802425E 01	0.806790E 01
0.2	0.863030E 01	0.867328E 01	0.871595E 01	0.875832E 01	0.880040E 01
0.0	0.139000E 02	0.139000E 02	0.139000E 02	0.140000E 02	0.140000E 02

P=29.5(.5)39

99.0	0.346510E 01	0.350799E 01	0.355058E 01	0.359286E 01	0.363484E 01
90.0	0.428613E 01	0.433080E 01	0.437511E 01	0.441909E 01	0.446273E 01
80.0	0.466835E 01	0.471350E 01	0.475828E 01	0.480271E 01	0.484680E 01
50.0	0.546244E 01	0.550801E 01	0.555321E 01	0.559804E 01	0.564251E 01
20.0	0.634194E 01	0.638724E 01	0.643218E 01	0.647675E 01	0.652098E 01
10.0	0.683672E 01	0.688160E 01	0.692611E 01	0.697027E 01	0.701410E 01
4.0	0.739150E 01	0.743568E 01	0.747952E 01	0.752302E 01	0.756620E 01
2.0	0.776500E 01	0.780860E 01	0.785188E 01	0.789484E 01	0.793748E 01
1.0	0.811122E 01	0.815421E 01	0.819691E 01	0.823928E 01	0.828136E 01
0.2	0.884219E 01	0.888369E 01	0.892493E 01	0.896589E 01	0.900658E 01
0.0	0.140000E 02	0.140000E 02	0.141000E 02	0.141000E 02	0.141000E 02
99.0	0.367654E 01	0.371795E 01	0.375908E 01	0.379994E 01	0.384053E 01
90.0	0.450604E 01	0.454903E 01	0.459171E 01	0.463408E 01	0.467615E 01
80.0	0.489054E 01	0.493396E 01	0.497705E 01	0.501982E 01	0.506229E 01
50.0	0.568664E 01	0.573043E 01	0.577389E 01	0.581702E 01	0.585983E 01
20.0	0.656486E 01	0.660841E 01	0.665163E 01	0.669453E 01	0.673712E 01
10.0	0.705759E 01	0.710075E 01	0.714359E 01	0.718613E 01	0.722835E 01
4.0	0.760907E 01	0.765161E 01	0.769386E 01	0.773580E 01	0.777746E 01
2.0	0.797982E 01	0.802186E 01	0.806360E 01	0.810506E 01	0.814623E 01
1.0	0.832315E 01	0.836465E 01	0.840587E 01	0.844680E 01	0.848748E 01
0.2	0.904701E 01	0.908719E 01	0.912711E 01	0.916679E 01	0.920622E 01
0.0	0.141000E 02	0.142000E 02	0.142000E 02	0.142000E 02	0.142000E 02
99.0	0.388085E 01	0.392092E 01	0.396073E 01	0.400030E 01	0.403962E 01
90.0	0.471792E 01	0.475941E 01	0.480062E 01	0.484155E 01	0.488221E 01
80.0	0.510445E 01	0.514632E 01	0.518790E 01	0.522919E 01	0.527020E 01
50.0	0.590234E 01	0.594454E 01	0.598644E 01	0.602805E 01	0.606938E 01
20.0	0.677940E 01	0.682138E 01	0.686307E 01	0.690447E 01	0.694559E 01
10.0	0.727028E 01	0.731192E 01	0.735327E 01	0.739434E 01	0.743514E 01
4.0	0.781882E 01	0.785991E 01	0.790072E 01	0.794126E 01	0.798154E 01
2.0	0.818713E 01	0.822776E 01	0.826812E 01	0.830822E 01	0.834807E 01
1.0	0.852788E 01	0.856802E 01	0.860792E 01	0.864755E 01	0.868695E 01
0.2	0.924542E 01	0.928437E 01	0.932310E 01	0.936161E 01	0.939988E 01
0.0	0.143000E 02	0.143000E 02	0.143000E 02	0.144000E 02	0.144000E 02
99.0	0.407870E 01	0.411755E 01	0.415616E 01	0.419455E 01	0.423271E 01
90.0	0.492260E 01	0.496273E 01	0.500260E 01	0.504223E 01	0.508161E 01
80.0	0.531095E 01	0.535142E 01	0.539163E 01	0.543159E 01	0.547129E 01
50.0	0.611042E 01	0.615120E 01	0.619170E 01	0.623194E 01	0.627193E 01
20.0	0.698644E 01	0.702701E 01	0.706732E 01	0.710738E 01	0.714717E 01
10.0	0.747566E 01	0.751593E 01	0.755593E 01	0.759568E 01	0.763518E 01
4.0	0.802156E 01	0.806132E 01	0.810083E 01	0.814010E 01	0.817914E 01
2.0	0.838767E 01	0.842701E 01	0.846612E 01	0.850499E 01	0.854363E 01
1.0	0.872609E 01	0.876501E 01	0.880369E 01	0.884214E 01	0.888037E 01
0.2	0.943794E 01	0.947579E 01	0.951342E 01	0.955084E 01	0.958806E 01
0.0	0.144000E 02	0.144000E 02	0.145000E 02	0.145000E 02	0.145000E 02

PERCENTAGE POINTS OF INCOMPLETE GAMMA-FUNCTION RATIO, $I'(U,P)$

P=39.5(.5)49

99.0	0.427066E 01	0.430839E 01	0.434591E 01	0.438322E 01	0.442032E 01
90.0	0.512075E 01	0.515965E 01	0.519832E 01	0.523675E 01	0.527497E 01
80.0	0.551074E 01	0.554996E 01	0.558893E 01	0.562767E 01	0.566617E 01
50.0	0.631166E 01	0.635114E 01	0.639038E 01	0.642938E 01	0.646814E 01
20.0	0.718672E 01	0.722602E 01	0.726508E 01	0.730390E 01	0.734249E 01
10.0	0.767443E 01	0.771345E 01	0.775223E 01	0.779078E 01	0.782909E 01
4.0	0.821793E 01	0.825649E 01	0.829482E 01	0.833293E 01	0.837082E 01
2.0	0.858204E 01	0.862022E 01	0.865819E 01	0.869594E 01	0.873347E 01
1.0	0.891837E 01	0.895616E 01	0.899374E 01	0.903111E 01	0.906826E 01
0.2	0.962508E 01	0.966190E 01	0.969852E 01	0.973495E 01	0.977119E 01
0.0	0.145000E 02	0.146000E 02	0.146000E 02	0.146000E 02	0.146000E 02
99.0	0.445722E 01	0.449393E 01	0.453043E 01	0.456675E 01	0.460288E 01
90.0	0.531296E 01	0.535074E 01	0.538830E 01	0.542565E 01	0.546280E 01
80.0	0.570446E 01	0.574252E 01	0.578036E 01	0.581798E 01	0.585540E 01
50.0	0.650668E 01	0.654498E 01	0.658307E 01	0.662093E 01	0.665858E 01
20.0	0.738085E 01	0.741899E 01	0.745691E 01	0.749461E 01	0.753210E 01
10.0	0.786719E 01	0.790507E 01	0.794273E 01	0.798018E 01	0.801742E 01
4.0	0.840850E 01	0.844596E 01	0.848322E 01	0.852027E 01	0.855711E 01
2.0	0.877080E 01	0.880792E 01	0.884483E 01	0.888155E 01	0.891807E 01
1.0	0.910523E 01	0.914198E 01	0.917854E 01	0.921490E 01	0.925108E 01
0.2	0.980724E 01	0.984312E 01	0.987880E 01	0.991431E 01	0.994965E 01
0.0	0.147000E 02	0.147000E 02	0.147000E 02	0.147000E 02	0.148000E 02
99.0	0.463882E 01	0.467457E 01	0.471015E 01	0.474555E 01	0.478077E 01
90.0	0.549974E 01	0.553648E 01	0.557303E 01	0.560938E 01	0.564554E 01
80.0	0.589261E 01	0.592961E 01	0.596642E 01	0.600302E 01	0.603943E 01
50.0	0.669603E 01	0.673325E 01	0.677027E 01	0.680709E 01	0.684372E 01
20.0	0.756938E 01	0.760645E 01	0.764333E 01	0.768000E 01	0.771648E 01
10.0	0.805446E 01	0.809129E 01	0.812793E 01	0.816437E 01	0.820062E 01
4.0	0.859376E 01	0.863021E 01	0.866647E 01	0.870255E 01	0.873843E 01
2.0	0.895439E 01	0.899053E 01	0.902648E 01	0.906224E 01	0.909783E 01
1.0	0.928707E 01	0.932287E 01	0.935850E 01	0.939394E 01	0.942921E 01
0.2	0.998480E 01	0.100198E 02	0.100546E 02	0.100893E 02	0.101238E 02
0.0	0.148000E 02	0.148000E 02	0.148000E 02	0.149000E 02	0.149000E 02
99.0	0.481582E 01	0.485070E 01	0.488541E 01	0.491995E 01	0.495434E 01
90.0	0.568152E 01	0.571731E 01	0.575292E 01	0.578834E 01	0.582360E 01
80.0	0.607565E 01	0.611168E 01	0.614753E 01	0.618319E 01	0.621867E 01
50.0	0.688015E 01	0.691639E 01	0.695244E 01	0.698830E 01	0.702398E 01
20.0	0.775276E 01	0.778885E 01	0.782476E 01	0.786049E 01	0.789603E 01
10.0	0.823668E 01	0.827255E 01	0.830824E 01	0.834375E 01	0.837908E 01
4.0	0.877414E 01	0.880965E 01	0.884499E 01	0.888016E 01	0.891516E 01
2.0	0.913323E 01	0.916846E 01	0.920352E 01	0.923840E 01	0.927311E 01
1.0	0.946430E 01	0.949922E 01	0.953398E 01	0.956856E 01	0.960299E 01
0.2	0.101581E 02	0.101923E 02	0.102263E 02	0.102601E 02	0.102938E 02
0.0	0.149000E 02	0.150000E 02	0.150000E 02	0.150000E 02	0.150000E 02

PERCENTAGE POINTS OF INCOMPLETE GAMMA-FUNCTION RATIO, I(U,P)

P=49.5(.5)59

99.0	0.498856E 01	0.502262E 01	0.505653E 01	0.509028E 01	0.512388E 01
90.0	0.585868E 01	0.589359E 01	0.592833E 01	0.596290E 01	0.599731E 01
80.0	0.625398E 01	0.628911E 01	0.632407E 01	0.635886E 01	0.639348E 01
50.0	0.705948E 01	0.709481E 01	0.712995E 01	0.716493E 01	0.719974E 01
20.0	0.793139E 01	0.796658E 01	0.800160E 01	0.803644E 01	0.807112E 01
10.0	0.841423E 01	0.844921E 01	0.848402E 01	0.851867E 01	0.855315E 01
4.0	0.894998E 01	0.898464E 01	0.901913E 01	0.905345E 01	0.908762E 01
2.0	0.930767E 01	0.934205E 01	0.937627E 01	0.941034E 01	0.944424E 01
1.0	0.963725E 01	0.967134E 01	0.970529E 01	0.973908E 01	0.977271E 01
0.2	0.103274E 02	0.103608E 02	0.103941E 02	0.104272E 02	0.104601E 02
0.0	0.151000E 02	0.151000E 02	0.151000E 02	0.151000E 02	0.152000E 02
99.0	0.515733E 01	0.519063E 01	0.522378E 01	0.525679E 01	0.528966E 01
90.0	0.603156E 01	0.606565E 01	0.609958E 01	0.613335E 01	0.616698E 01
80.0	0.642794E 01	0.646224E 01	0.649637E 01	0.653035E 01	0.656417E 01
50.0	0.723437E 01	0.726885E 01	0.730316E 01	0.733731E 01	0.737130E 01
20.0	0.810563E 01	0.813998E 01	0.817416E 01	0.820819E 01	0.824206E 01
10.0	0.858746E 01	0.862162E 01	0.865562E 01	0.868946E 01	0.872315E 01
4.0	0.912163E 01	0.915548E 01	0.918918E 01	0.922272E 01	0.925612E 01
2.0	0.947800E 01	0.951160E 01	0.954505E 01	0.957835E 01	0.961150E 01
1.0	0.980620E 01	0.983954E 01	0.987272E 01	0.990577E 01	0.993867E 01
0.2	0.104930E 02	0.105257E 02	0.105582E 02	0.105906E 02	0.106229E 02
0.0	0.152000E 02	0.152000E 02	0.152000E 02	0.153000E 02	0.153000E 02
99.0	0.532238E 01	0.535497E 01	0.538742E 01	0.541974E 01	0.545192E 01
90.0	0.620045E 01	0.623377E 01	0.626695E 01	0.629998E 01	0.633287E 01
80.0	0.659784E 01	0.663136E 01	0.666473E 01	0.669794E 01	0.673102E 01
50.0	0.740514E 01	0.743882E 01	0.747235E 01	0.750573E 01	0.753896E 01
20.0	0.827578E 01	0.830934E 01	0.834276E 01	0.837602E 01	0.840914E 01
10.0	0.875668E 01	0.879006E 01	0.882330E 01	0.885639E 01	0.888934E 01
4.0	0.928937E 01	0.932247E 01	0.935542E 01	0.938824E 01	0.942091E 01
2.0	0.964451E 01	0.967738E 01	0.971010E 01	0.974269E 01	0.977514E 01
1.0	0.997143E 01	0.100041E 02	0.100365E 02	0.100689E 02	0.101011E 02
0.2	0.106551E 02	0.106871E 02	0.107190E 02	0.107507E 02	0.107824E 02
0.0	0.153000E 02	0.153000E 02	0.154000E 02	0.154000E 02	0.154000E 02
99.0	0.548397E 01	0.551589E 01	0.554768E 01	0.557934E 01	0.561087E 01
90.0	0.636562E 01	0.639822E 01	0.643069E 01	0.646303E 01	0.649523E 01
80.0	0.676395E 01	0.679674E 01	0.682939E 01	0.686190E 01	0.689427E 01
50.0	0.757205E 01	0.760499E 01	0.763779E 01	0.767045E 01	0.770298E 01
20.0	0.844212E 01	0.847495E 01	0.850764E 01	0.854019E 01	0.857261E 01
10.0	0.892214E 01	0.895481E 01	0.898733E 01	0.901972E 01	0.905197E 01
4.0	0.945345E 01	0.948585E 01	0.951811E 01	0.955024E 01	0.958224E 01
2.0	0.980746E 01	0.983963E 01	0.987168E 01	0.990359E 01	0.993538E 01
1.0	0.101332E 02	0.101651E 02	0.101969E 02	0.102286E 02	0.102602E 02
0.2	0.108139E 02	0.108452E 02	0.108765E 02	0.109076E 02	0.109387E 02
0.0	0.154000E 02	0.155000E 02	0.155000E 02	0.155000E 02	0.155000E 02

PERCENTAGE POINTS OF INCOMPLETE GAMMA-FUNCTION RATIO, $I'(U,P)$

P=59.5(.5)69

99.0	0.564229E 01	0.567357E 01	0.570474E 01	0.573579E 01	0.576672E 01
90.0	0.652729E 01	0.655923E 01	0.659104E 01	0.662272E 01	0.665427E 01
80.0	0.692651E 01	0.695862E 01	0.699059E 01	0.702244E 01	0.705415E 01
50.0	0.773536E 01	0.776761E 01	0.779973E 01	0.783172E 01	0.786357E 01
20.0	0.860489E 01	0.863703E 01	0.866905E 01	0.870093E 01	0.873269E 01
10.0	0.908409E 01	0.911608E 01	0.914794E 01	0.917967E 01	0.921127E 01
4.0	0.961411E 01	0.964584E 01	0.967746E 01	0.970894E 01	0.974030E 01
2.0	0.996703E 01	0.999857E 01	0.100300E 02	0.100613E 02	0.100924E 02
1.0	0.102916E 02	0.103229E 02	0.103541E 02	0.103852E 02	0.104162E 02
0.2	0.109696E 02	0.110004E 02	0.110310E 02	0.110616E 02	0.110920E 02
0.0	0.156000E 02	0.156000E 02	0.156000E 02	0.156000E 02	0.157000E 02
99.0	0.579753E 01	0.582822E 01	0.585880E 01	0.588927E 01	0.591962E 01
90.0	0.668570E 01	0.671700E 01	0.674819E 01	0.677925E 01	0.681019E 01
80.0	0.708574E 01	0.711721E 01	0.714855E 01	0.717977E 01	0.721086E 01
50.0	0.789530E 01	0.792690E 01	0.795837E 01	0.798972E 01	0.802095E 01
20.0	0.876431E 01	0.879581E 01	0.882719E 01	0.885845E 01	0.888958E 01
10.0	0.924275E 01	0.927410E 01	0.930533E 01	0.933644E 01	0.936743E 01
4.0	0.977154E 01	0.980266E 01	0.983366E 01	0.986453E 01	0.989530E 01
2.0	0.101235E 02	0.101544E 02	0.101852E 02	0.102159E 02	0.102465E 02
1.0	0.104470E 02	0.104777E 02	0.105083E 02	0.105388E 02	0.105692E 02
0.2	0.111224E 02	0.111526E 02	0.111827E 02	0.112127E 02	0.112426E 02
0.0	0.157000E 02	0.157000E 02	0.157000E 02	0.158000E 02	0.158000E 02
99.0	0.594986E 01	0.598000E 01	0.601002E 01	0.603994E 01	0.606975E 01
90.0	0.684102E 01	0.687173E 01	0.690232E 01	0.693280E 01	0.696317E 01
80.0	0.724184E 01	0.727270E 01	0.730344E 01	0.733407E 01	0.736459E 01
50.0	0.805206E 01	0.808304E 01	0.811391E 01	0.814466E 01	0.817530E 01
20.0	0.892059E 01	0.895148E 01	0.898226E 01	0.901292E 01	0.904347E 01
10.0	0.939830E 01	0.942905E 01	0.945969E 01	0.949021E 01	0.952062E 01
4.0	0.992594E 01	0.995647E 01	0.998690E 01	0.100172E 02	0.100474E 02
2.0	0.102769E 02	0.103073E 02	0.103375E 02	0.103676E 02	0.103977E 02
1.0	0.105995E 02	0.106296E 02	0.106597E 02	0.106896E 02	0.107194E 02
0.2	0.112724E 02	0.113021E 02	0.113317E 02	0.113611E 02	0.113905E 02
0.0	0.158000E 02	0.158000E 02	0.159000E 02	0.159000E 02	0.159000E 02
99.0	0.609945E 01	0.612906E 01	0.615855E 01	0.618795E 01	0.621725E 01
90.0	0.699342E 01	0.702357E 01	0.705361E 01	0.708353E 01	0.711336E 01
80.0	0.739498E 01	0.742527E 01	0.745545E 01	0.748552E 01	0.751548E 01
50.0	0.820582E 01	0.823623E 01	0.826653E 01	0.829672E 01	0.832679E 01
20.0	0.907390E 01	0.910422E 01	0.913443E 01	0.916453E 01	0.919452E 01
10.0	0.955092E 01	0.958110E 01	0.961118E 01	0.964115E 01	0.967101E 01
4.0	0.100775E 02	0.101075E 02	0.101373E 02	0.101671E 02	0.101968E 02
2.0	0.104276E 02	0.104574E 02	0.104871E 02	0.105167E 02	0.105461E 02
1.0	0.107492E 02	0.107788E 02	0.108083E 02	0.108377E 02	0.108670E 02
0.2	0.114198E 02	0.114490E 02	0.114781E 02	0.115070E 02	0.115359E 02
0.0	0.159000E 02	0.160000E 02	0.160000E 02	0.160000E 02	0.160000E 02

PERCENTAGE POINTS OF INCOMPLETE GAMMA-FUNCTION RATIO, $I'(U,P)$

P=69.5(.5)74(1)84

99.0	0.624644E 01	0.627554E 01	0.630454E 01	0.633344E 01	0.636224E 01
90.0	0.714308E 01	0.717269E 01	0.720220E 01	0.723160E 01	0.726091E 01
80.0	0.754534E 01	0.757508E 01	0.760473E 01	0.763427E 01	0.766370E 01
50.0	0.835676E 01	0.838662E 01	0.841638E 01	0.844603E 01	0.847558E 01
20.0	0.922440E 01	0.925418E 01	0.928385E 01	0.931342E 01	0.934289E 01
10.0	0.970077E 01	0.973042E 01	0.975997E 01	0.978941E 01	0.981876E 01
4.0	0.102263E 02	0.102558E 02	0.102851E 02	0.103144E 02	0.103435E 02
2.0	0.105755E 02	0.106048E 02	0.106340E 02	0.106631E 02	0.106921E 02
1.0	0.108963E 02	0.109254E 02	0.109544E 02	0.109833E 02	0.110121E 02
0.2	0.115647E 02	0.115934E 02	0.116220E 02	0.116505E 02	0.116790E 02
0.0	0.161000E 02	0.161000E 02	0.161000E 02	0.161000E 02	0.162000E 02
99.0	0.639095E 01	0.641957E 01	0.644809E 01	0.647653E 01	0.650487E 01
90.0	0.729012E 01	0.731923E 01	0.734824E 01	0.737715E 01	0.740596E 01
80.0	0.769304E 01	0.772227E 01	0.775141E 01	0.778045E 01	0.780939E 01
50.0	0.850502E 01	0.853436E 01	0.856361E 01	0.859275E 01	0.862179E 01
20.0	0.937225E 01	0.940151E 01	0.943067E 01	0.945974E 01	0.948871E 01
10.0	0.984800E 01	0.987714E 01	0.990618E 01	0.993513E 01	0.996398E 01
4.0	0.103726E 02	0.104015E 02	0.104304E 02	0.104591E 02	0.104878E 02
2.0	0.107210E 02	0.107498E 02	0.107785E 02	0.108071E 02	0.108356E 02
1.0	0.110409E 02	0.110695E 02	0.110980E 02	0.111265E 02	0.111549E 02
0.2	0.117073E 02	0.117355E 02	0.117637E 02	0.117917E 02	0.118197E 02
0.0	0.162000E 02	0.162000E 02	0.162000E 02	0.163000E 02	0.163000E 02
99.0	0.656128E 01	0.661733E 01	0.667304E 01	0.672840E 01	0.678343E 01
90.0	0.746331E 01	0.752028E 01	0.757689E 01	0.763314E 01	0.768904E 01
80.0	0.786698E 01	0.792419E 01	0.798104E 01	0.803752E 01	0.809364E 01
50.0	0.867959E 01	0.873701E 01	0.879405E 01	0.885072E 01	0.890703E 01
20.0	0.954635E 01	0.960361E 01	0.966050E 01	0.971703E 01	0.977320E 01
10.0	0.100214E 02	0.100784E 02	0.101351E 02	0.101914E 02	0.102474E 02
4.0	0.105449E 02	0.106015E 02	0.106579E 02	0.107138E 02	0.107695E 02
2.0	0.108924E 02	0.109488E 02	0.110048E 02	0.110605E 02	0.111158E 02
1.0	0.112113E 02	0.112674E 02	0.113231E 02	0.113785E 02	0.114336E 02
0.2	0.118754E 02	0.119307E 02	0.119857E 02	0.120404E 02	0.120948E 02
0.0	0.163000E 02	0.164000E 02	0.164000E 02	0.165000E 02	0.165000E 02
99.0	0.683812E 01	0.689250E 01	0.694655E 01	0.700030E 01	0.705373E 01
90.0	0.774459E 01	0.779980E 01	0.785468E 01	0.790923E 01	0.796346E 01
80.0	0.814941E 01	0.820484E 01	0.825993E 01	0.831469E 01	0.836913E 01
50.0	0.896299E 01	0.901860E 01	0.907387E 01	0.912881E 01	0.918341E 01
20.0	0.982902E 01	0.988449E 01	0.993963E 01	0.999443E 01	0.100489E 02
10.0	0.103030E 02	0.103583E 02	0.104132E 02	0.104678E 02	0.105221E 02
4.0	0.108247E 02	0.108797E 02	0.109343E 02	0.109886E 02	0.110426E 02
2.0	0.111709E 02	0.112255E 02	0.112799E 02	0.113339E 02	0.113877E 02
1.0	0.114883E 02	0.115427E 02	0.115968E 02	0.116506E 02	0.117040E 02
0.2	0.121488E 02	0.122025E 02	0.122560E 02	0.123091E 02	0.123619E 02
0.0	0.166000E 02	0.166000E 02	0.167000E 02	0.167000E 02	0.167000E 02

PERCENTAGE POINTS OF INCOMPLETE GAMMA-FUNCTION RATIO, $I'(U,P)$

P=85(1)104

99.0	0.710687E 01	0.715970E 01	0.721225E 01	0.726450E 01	0.731648E 01
90.0	0.801737E 01	0.807097E 01	0.812427E 01	0.817726E 01	0.822997E 01
80.0	0.842324E 01	0.847704E 01	0.853053E 01	0.858372E 01	0.863661E 01
50.0	0.923770E 01	0.929167E 01	0.934532E 01	0.939867E 01	0.945172E 01
20.0	0.101031E 02	0.101569E 02	0.102104E 02	0.102637E 02	0.103166E 02
10.0	0.105760E 02	0.106297E 02	0.106830E 02	0.107361E 02	0.107888E 02
4.0	0.110963E 02	0.111496E 02	0.112027E 02	0.112554E 02	0.113079E 02
2.0	0.114411E 02	0.114942E 02	0.115470E 02	0.115996E 02	0.116518E 02
1.0	0.117572E 02	0.118101E 02	0.118626E 02	0.119149E 02	0.119669E 02
0.2	0.124144E 02	0.124667E 02	0.125186E 02	0.125703E 02	0.126217E 02
0.0	0.168000E 02	0.168000E 02	0.169000E 02	0.169000E 02	0.170000E 02
99.0	0.736817E 01	0.741959E 01	0.747074E 01	0.752163E 01	0.757226E 01
90.0	0.828238E 01	0.833451E 01	0.838635E 01	0.843792E 01	0.848922E 01
80.0	0.868921E 01	0.874152E 01	0.879354E 01	0.884529E 01	0.889676E 01
50.0	0.950447E 01	0.955693E 01	0.960911E 01	0.966100E 01	0.971262E 01
20.0	0.103692E 02	0.104216E 02	0.104736E 02	0.105254E 02	0.105769E 02
10.0	0.108413E 02	0.108935E 02	0.109454E 02	0.109970E 02	0.110483E 02
4.0	0.113601E 02	0.114120E 02	0.114636E 02	0.115150E 02	0.115660E 02
2.0	0.117037E 02	0.117554E 02	0.118068E 02	0.118580E 02	0.119088E 02
1.0	0.120186E 02	0.120701E 02	0.121212E 02	0.121722E 02	0.122228E 02
0.2	0.126729E 02	0.127237E 02	0.127744E 02	0.128247E 02	0.128748E 02
0.0	0.170000E 02	0.171000E 02	0.171000E 02	0.172000E 02	0.172000E 02
99.0	0.762262E 01	0.767274E 01	0.772260E 01	0.777222E 01	0.782160E 01
90.0	0.854025E 01	0.859101E 01	0.864152E 01	0.869177E 01	0.874177E 01
80.0	0.894796E 01	0.899889E 01	0.904957E 01	0.909998E 01	0.915014E 01
50.0	0.976396E 01	0.981503E 01	0.986584E 01	0.991639E 01	0.996669E 01
20.0	0.106281E 02	0.106791E 02	0.107298E 02	0.107803E 02	0.108304E 02
10.0	0.110994E 02	0.111502E 02	0.112007E 02	0.112510E 02	0.113011E 02
4.0	0.116169E 02	0.116674E 02	0.117177E 02	0.117678E 02	0.118176E 02
2.0	0.119594E 02	0.120098E 02	0.120599E 02	0.121097E 02	0.121593E 02
1.0	0.122732E 02	0.123233E 02	0.123732E 02	0.124229E 02	0.124723E 02
0.2	0.129247E 02	0.129743E 02	0.130237E 02	0.130728E 02	0.131217E 02
0.0	0.172000E 02	0.173000E 02	0.173000E 02	0.174000E 02	0.174000E 02
99.0	0.787074E 01	0.791964E 01	0.796831E 01	0.801675E 01	0.806497E 01
90.0	0.879152E 01	0.884102E 01	0.889029E 01	0.893932E 01	0.898811E 01
80.0	0.920005E 01	0.924971E 01	0.929913E 01	0.934831E 01	0.939725E 01
50.0	0.100167E 02	0.100666E 02	0.101161E 02	0.101654E 02	0.102144E 02
20.0	0.108804E 02	0.109301E 02	0.109795E 02	0.110287E 02	0.110777E 02
10.0	0.113508E 02	0.114004E 02	0.114497E 02	0.114987E 02	0.115476E 02
4.0	0.118671E 02	0.119164E 02	0.119655E 02	0.120143E 02	0.120629E 02
2.0	0.122087E 02	0.122578E 02	0.123067E 02	0.123554E 02	0.124038E 02
1.0	0.125214E 02	0.125703E 02	0.126190E 02	0.126675E 02	0.127157E 02
0.2	0.131704E 02	0.132188E 02	0.132670E 02	0.133150E 02	0.133628E 02
0.0	0.175000E 02	0.175000E 02	0.175000E 02	0.176000E 02	0.176000E 02

PERCENTAGE POINTS OF INCOMPLETE GAMMA-FUNCTION RATIO, $I'(U,P)$

P=105(1)124

99.0	0.811296E 01	0.816073E 01	0.820829E 01	0.825564E 01	0.830278E 01
90.0	0.903667E 01	0.908501E 01	0.913312E 01	0.918101E 01	0.922868E 01
80.0	0.944597E 01	0.949445E 01	0.954270E 01	0.959073E 01	0.963855E 01
50.0	0.102633E 02	0.103119E 02	0.103602E 02	0.104084E 02	0.104563E 02
20.0	0.111264E 02	0.111749E 02	0.112232E 02	0.112713E 02	0.113191E 02
10.0	0.115962E 02	0.116445E 02	0.116927E 02	0.117406E 02	0.117883E 02
4.0	0.121113E 02	0.121595E 02	0.122074E 02	0.122551E 02	0.123026E 02
2.0	0.124520E 02	0.125000E 02	0.125477E 02	0.125953E 02	0.126426E 02
1.0	0.127637E 02	0.128115E 02	0.128591E 02	0.129065E 02	0.129536E 02
0.2	0.134103E 02	0.134577E 02	0.135048E 02	0.135517E 02	0.135984E 02
0.0	0.177000E 02	0.177000E 02	0.178000E 02	0.178000E 02	0.178000E 02
99.0	0.834969E 01	0.839641E 01	0.844293E 01	0.848925E 01	0.853537E 01
90.0	0.927614E 01	0.932339E 01	0.937042E 01	0.941725E 01	0.946387E 01
80.0	0.968614E 01	0.973352E 01	0.978069E 01	0.982765E 01	0.987441E 01
50.0	0.105040E 02	0.105515E 02	0.105988E 02	0.106459E 02	0.106927E 02
20.0	0.113667E 02	0.114141E 02	0.114613E 02	0.115083E 02	0.115551E 02
10.0	0.118358E 02	0.118831E 02	0.119301E 02	0.119770E 02	0.120237E 02
4.0	0.123499E 02	0.123970E 02	0.124439E 02	0.124905E 02	0.125370E 02
2.0	0.126897E 02	0.127366E 02	0.127833E 02	0.128298E 02	0.128761E 02
1.0	0.130006E 02	0.130473E 02	0.130938E 02	0.131402E 02	0.131863E 02
0.2	0.136449E 02	0.136913E 02	0.137374E 02	0.137833E 02	0.138290E 02
0.0	0.179000E 02	0.179000E 02	0.180000E 02	0.180000E 02	0.181000E 02
99.0	0.858130E 01	0.862703E 01	0.867257E 01	0.871793E 01	0.876310E 01
90.0	0.951030E 01	0.955652E 01	0.960255E 01	0.964839E 01	0.969403E 01
80.0	0.992096E 01	0.996731E 01	0.100135E 02	0.100594E 02	0.101052E 02
50.0	0.107394E 02	0.107859E 02	0.108321E 02	0.108782E 02	0.109240E 02
20.0	0.116017E 02	0.116480E 02	0.116942E 02	0.117402E 02	0.117860E 02
10.0	0.120701E 02	0.121164E 02	0.121624E 02	0.122083E 02	0.122540E 02
4.0	0.125832E 02	0.126293E 02	0.126752E 02	0.127209E 02	0.127663E 02
2.0	0.129222E 02	0.129681E 02	0.130139E 02	0.130594E 02	0.131047E 02
1.0	0.132322E 02	0.132780E 02	0.133235E 02	0.133689E 02	0.134141E 02
0.2	0.138746E 02	0.139199E 02	0.139651E 02	0.140101E 02	0.140549E 02
0.0	0.181000E 02	0.181000E 02	0.182000E 02	0.182000E 02	0.183000E 02
99.0	0.880809E 01	0.885289E 01	0.889752E 01	0.894197E 01	0.898625E 01
90.0	0.973949E 01	0.978476E 01	0.982984E 01	0.987474E 01	0.991946E 01
80.0	0.101508E 02	0.101962E 02	0.102414E 02	0.102864E 02	0.103312E 02
50.0	0.109697E 02	0.110152E 02	0.110606E 02	0.111056E 02	0.111505E 02
20.0	0.118316E 02	0.118770E 02	0.119222E 02	0.119672E 02	0.120121E 02
10.0	0.122994E 02	0.123447E 02	0.123898E 02	0.124348E 02	0.124795E 02
4.0	0.128116E 02	0.128568E 02	0.129017E 02	0.129465E 02	0.129910E 02
2.0	0.131499E 02	0.131949E 02	0.132397E 02	0.132843E 02	0.133287E 02
1.0	0.134591E 02	0.135039E 02	0.135486E 02	0.135930E 02	0.136373E 02
0.2	0.140995E 02	0.141440E 02	0.141882E 02	0.142323E 02	0.142763E 02
0.0	0.183000E 02	0.183000E 02	0.184000E 02	0.184000E 02	0.185000E 02

PERCENTAGE POINTS OF INCOMPLETE GAMMA-FUNCTION RATIO, I'(U,P)

P=125(1)144

99.0	0.903035E 01	0.907429E 01	0.911805E 01	0.916165E 01	0.920508E 01
90.0	0.996400E 01	0.100084E 02	0.100526E 02	0.100966E 02	0.101404E 02
80.0	0.103759E 02	0.104203E 02	0.104647E 02	0.105088E 02	0.105527E 02
50.0	0.111953E 02	0.112399E 02	0.112843E 02	0.113285E 02	0.113725E 02
20.0	0.120568E 02	0.121013E 02	0.121456E 02	0.121897E 02	0.122337E 02
10.0	0.125241E 02	0.125685E 02	0.126127E 02	0.126567E 02	0.127006E 02
4.0	0.130354E 02	0.130797E 02	0.131237E 02	0.131676E 02	0.132113E 02
2.0	0.133730E 02	0.134170E 02	0.134610E 02	0.135047E 02	0.135483E 02
1.0	0.136814E 02	0.137254E 02	0.137692E 02	0.138128E 02	0.138562E 02
0.2	0.143200E 02	0.143636E 02	0.144071E 02	0.144503E 02	0.144934E 02
0.0	0.185000E 02	0.185000E 02	0.186000E 02	0.186000E 02	0.187000E 02
99.0	0.924835E 01	0.929146E 01	0.933441E 01	0.937721E 01	0.941984E 01
90.0	0.101841E 02	0.102277E 02	0.102710E 02	0.103142E 02	0.103572E 02
80.0	0.105965E 02	0.106402E 02	0.106836E 02	0.107269E 02	0.107701E 02
50.0	0.114164E 02	0.114602E 02	0.115037E 02	0.115471E 02	0.115903E 02
20.0	0.122775E 02	0.123212E 02	0.123647E 02	0.124080E 02	0.124511E 02
10.0	0.127443E 02	0.127879E 02	0.128312E 02	0.128745E 02	0.129175E 02
4.0	0.132549E 02	0.132982E 02	0.133415E 02	0.133845E 02	0.134274E 02
2.0	0.135917E 02	0.136350E 02	0.136781E 02	0.137210E 02	0.137638E 02
1.0	0.138995E 02	0.139426E 02	0.139856E 02	0.140284E 02	0.140710E 02
0.2	0.145364E 02	0.145792E 02	0.146218E 02	0.146643E 02	0.147067E 02
0.0	0.187000E 02	0.187000E 02	0.188000E 02	0.188000E 02	0.189000E 02
99.0	0.946233E 01	0.950466E 01	0.954684E 01	0.958887E 01	0.963075E 01
90.0	0.104001E 02	0.104428E 02	0.104854E 02	0.105278E 02	0.105701E 02
80.0	0.108130E 02	0.108559E 02	0.108985E 02	0.109410E 02	0.109834E 02
50.0	0.116333E 02	0.116762E 02	0.117190E 02	0.117616E 02	0.118040E 02
20.0	0.124941E 02	0.125369E 02	0.125796E 02	0.126221E 02	0.126645E 02
10.0	0.129604E 02	0.130032E 02	0.130457E 02	0.130882E 02	0.131304E 02
4.0	0.134702E 02	0.135128E 02	0.135552E 02	0.135975E 02	0.136396E 02
2.0	0.138064E 02	0.138489E 02	0.138912E 02	0.139334E 02	0.139754E 02
1.0	0.141135E 02	0.141559E 02	0.141981E 02	0.142401E 02	0.142820E 02
0.2	0.147488E 02	0.147909E 02	0.148327E 02	0.148745E 02	0.149161E 02
0.0	0.189000E 02	0.189000E 02	0.190000E 02	0.190000E 02	0.190000E 02
99.0	0.967249E 01	0.971408E 01	0.975553E 01	0.979684E 01	0.983800E 01
90.0	0.106122E 02	0.106541E 02	0.106959E 02	0.107376E 02	0.107791E 02
80.0	0.110256E 02	0.110676E 02	0.111095E 02	0.111513E 02	0.111929E 02
50.0	0.118463E 02	0.118884E 02	0.119304E 02	0.119722E 02	0.120139E 02
20.0	0.127067E 02	0.127488E 02	0.127907E 02	0.128325E 02	0.128741E 02
10.0	0.131726E 02	0.132146E 02	0.132564E 02	0.132981E 02	0.133396E 02
4.0	0.136816E 02	0.137234E 02	0.137651E 02	0.138067E 02	0.138481E 02
2.0	0.140172E 02	0.140590E 02	0.141006E 02	0.141420E 02	0.141833E 02
1.0	0.143237E 02	0.143653E 02	0.144068E 02	0.144481E 02	0.144893E 02
0.2	0.149575E 02	0.149988E 02	0.150400E 02	0.150810E 02	0.151219E 02
0.0	0.191000E 02	0.191000E 02	0.192000E 02	0.192000E 02	0.192000E 02

PERCENTAGE POINTS OF INCOMPLETE GAMMA-FUNCTION RATIO, $I'(U,P)$

P=145(1)164

99.0	0.987903E 01	0.991992E 01	0.996068E 01	0.100013E 02	0.100418E 02
90.0	0.108205E 02	0.108618E 02	0.109029E 02	0.109438E 02	0.109847E 02
80.0	0.112344E 02	0.112757E 02	0.113169E 02	0.113580E 02	0.113989E 02
50.0	0.120555E 02	0.120969E 02	0.121381E 02	0.121793E 02	0.122202E 02
20.0	0.129156E 02	0.129570E 02	0.129982E 02	0.130392E 02	0.130802E 02
10.0	0.133810E 02	0.134223E 02	0.134634E 02	0.135044E 02	0.135452E 02
4.0	0.138894E 02	0.139305E 02	0.139715E 02	0.140123E 02	0.140530E 02
2.0	0.142244E 02	0.142654E 02	0.143063E 02	0.143471E 02	0.143877E 02
1.0	0.145303E 02	0.145712E 02	0.146120E 02	0.146526E 02	0.146931E 02
0.2	0.151627E 02	0.152033E 02	0.152438E 02	0.152842E 02	0.153244E 02
0.0	0.193000E 02	0.193000E 02	0.194000E 02	0.194000E 02	0.194000E 02
99.0	0.100821E 02	0.101224E 02	0.101625E 02	0.102024E 02	0.102423E 02
90.0	0.110253E 02	0.110659E 02	0.111063E 02	0.111466E 02	0.111868E 02
80.0	0.114397E 02	0.114803E 02	0.115208E 02	0.115612E 02	0.116014E 02
50.0	0.122611E 02	0.123018E 02	0.123424E 02	0.123828E 02	0.124231E 02
20.0	0.131209E 02	0.131616E 02	0.132021E 02	0.132425E 02	0.132828E 02
10.0	0.135859E 02	0.136265E 02	0.136669E 02	0.137072E 02	0.137474E 02
4.0	0.140936E 02	0.141341E 02	0.141744E 02	0.142146E 02	0.142546E 02
2.0	0.144281E 02	0.144685E 02	0.145087E 02	0.145488E 02	0.145887E 02
1.0	0.147335E 02	0.147737E 02	0.148138E 02	0.148538E 02	0.148936E 02
0.2	0.153645E 02	0.154044E 02	0.154443E 02	0.154840E 02	0.155236E 02
0.0	0.195000E 02	0.195000E 02	0.195000E 02	0.196000E 02	0.196000E 02
99.0	0.102820E 02	0.103216E 02	0.103610E 02	0.104004E 02	0.104396E 02
90.0	0.112268E 02	0.112667E 02	0.113065E 02	0.113461E 02	0.113857E 02
80.0	0.116415E 02	0.116815E 02	0.117214E 02	0.117611E 02	0.118007E 02
50.0	0.124633E 02	0.125034E 02	0.125433E 02	0.125831E 02	0.126228E 02
20.0	0.133229E 02	0.133629E 02	0.134028E 02	0.134425E 02	0.134821E 02
10.0	0.137875E 02	0.138274E 02	0.138672E 02	0.139069E 02	0.139464E 02
4.0	0.142945E 02	0.143343E 02	0.143740E 02	0.144136E 02	0.144530E 02
2.0	0.146286E 02	0.146683E 02	0.147078E 02	0.147473E 02	0.147866E 02
1.0	0.149334E 02	0.149730E 02	0.150124E 02	0.150518E 02	0.150910E 02
0.2	0.155631E 02	0.156024E 02	0.156416E 02	0.156807E 02	0.157197E 02
0.0	0.196000E 02	0.197000E 02	0.197000E 02	0.198000E 02	0.198000E 02
99.0	0.104787E 02	0.105177E 02	0.105565E 02	0.105953E 02	0.106339E 02
90.0	0.114251E 02	0.114644E 02	0.115035E 02	0.115426E 02	0.115815E 02
80.0	0.118402E 02	0.118796E 02	0.119188E 02	0.119579E 02	0.119969E 02
50.0	0.126623E 02	0.127017E 02	0.127410E 02	0.127802E 02	0.128193E 02
20.0	0.135216E 02	0.135610E 02	0.136003E 02	0.136394E 02	0.136784E 02
10.0	0.139858E 02	0.140251E 02	0.140643E 02	0.141034E 02	0.141423E 02
4.0	0.144923E 02	0.145315E 02	0.145705E 02	0.146095E 02	0.146483E 02
2.0	0.148258E 02	0.148649E 02	0.149039E 02	0.149427E 02	0.149815E 02
1.0	0.151301E 02	0.151691E 02	0.152080E 02	0.152467E 02	0.152854E 02
0.2	0.157586E 02	0.157973E 02	0.158360E 02	0.158745E 02	0.159129E 02
0.0	0.198000E 02	0.199000E 02	0.199000E 02	0.199000E 02	0.199000E 02

Table 3.--Percentage points of the chi-square distribution[1/]

$\nu = 0.1(0.1)\ 10.0$

$\gamma = 0.05(0.05)\ 5.0$

$p = -0.95(0.05)\ 4.0$

The values in the body of Harter's table 2 are the values of chi square that correspond to these values of ν (degrees of freedom, reading across, then down) for P = .0001, .0005, .0010, .0050, .0100, .0250, .0500, .1000 (.1000), .9000, .9750, .9900, .9950, .9990, .9995, and .9999 (probability (less than) and I' = 100(1 − P)). Table 1, Percentage points of incomplete gamma-function ratio, I' (U,P) was based on this table. Table 3 (10 pp.) supplements table 1 for probabilities not listed in table 1. Basic formulas for this table follow:

$$\chi^2/2 = X_i/\beta = u\sqrt{\gamma} \qquad X_i = u\beta\sqrt{\gamma}$$

$$\nu = 2\gamma \qquad \beta = \bar{X}/\gamma \qquad X_i = (X_i/\beta)(\beta)$$

Example 1: Given $\gamma = 0.25$ $\quad p = \gamma - 1 = -0.75$

$\nu = 2\gamma = 0.50$ $\quad \chi^2 = 0.875289E\ 01$

I' = 0.1 or P = 0.9990 $\quad u = 8.75289$

Example 2: Given $\gamma = 0.50$ $\quad \nu = 2\gamma = 1.0$ $\quad p = -0.50$

I' = 50.0 or $\quad$ P = 0.5000

$\chi^2/2 = u\sqrt{0.50} \qquad \chi^2 = 0.454936$

$$\frac{0.454936}{2} = u\sqrt{0.50}$$

$$0.227468 = u(0.7071067811)$$

$$u = 0.32168833 \text{ or}$$

0.321689 as read directly from table 1, page 1 of 5

1/ After Harter, H. L. More tables of the incomplete gamma-function ratio and of percentage points of the chi-square distribution. U.S. Air Force Aerospace Res. Lab. Tech. Rpt. 64-123. 92 pp. 1964. (For sale Office of Technical Services, U.S. Dept. Commerce, $2.25.)

PERCENTAGE POINTS OF THE CHI-SQUARE DISTRIBUTION

P	ν	0.1	0.2	0.3	0.4	0.5
.0001		0.116893E-79	0.121461E-39	0.271457E-26	0.130510E-19	0.134994E-15
.0005		0.111478E-65	0.118614E-32	0.124023E-21	0.407843E-16	0.843712E-13
.0010		0.116893E-59	0.121461E-29	0.125999E-19	0.130510E-14	0.134994E-11
.0050		0.111478E-45	0.118614E-22	0.575663E-15	0.407843E-11	0.843712E-09
.0100		0.116893E-39	0.121461E-19	0.584837E-13	0.130510E-09	0.134994E-07
.0250		0.106313E-31	0.115834E-15	0.263007E-10	0.127451E-07	0.527320E-06
.0500		0.111478E-25	0.118614E-12	0.267199E-08	0.407843E-06	0.843715E-05
.1000		0.116893E-19	0.121461E-09	0.271457E-06	0.130510E-04	0.135001E-03
.2000		0.122571E-13	0.124376E-06	0.275787E-04	0.417703E-03	0.216177E-02
.3000		0.407579E-10	0.717217E-05	0.411706E-03	0.317558E-02	0.109826E-01
.4000		0.128525E-07	0.127368E-03	0.280520E-02	0.134391E-01	0.350448E-01
.5000		0.111478E-05	0.118678E-02	0.124696E-01	0.414927E-01	0.873476E-01
.6000		0.427387E-04	0.736890E-02	0.425976E-01	0.106021E-00	0.188412E-00
.7000		0.933127E-03	0.348556E-01	0.123216E-00	0.242075E-00	0.374696E-00
.8000		0.135640E-01	0.138780E-00	0.326574E-00	0.527087E 00	0.726170E 00
.9000		0.152634E-00	0.532309E 00	0.889597E 00	0.120980E 01	0.150078E 01
.9500		0.531865E 00	0.116087E 01	0.165117E 01	0.206105E 01	0.242023E 01
.9750		0.113435E 01	0.195581E 01	0.254506E 01	0.302221E 01	0.343324E 01
.9900		0.217525E 01	0.317696E 01	0.386119E 01	0.440461E 01	0.486777E 01
.9950		0.308925E 01	0.418912E 01	0.492727E 01	0.550939E 01	0.600362E 01
.9990		0.547292E 01	0.672735E 01	0.755521E 01	0.820393E 01	0.875289E 01
.9995		0.657533E 01	0.787676E 01	0.873335E 01	0.940409E 01	0.997154E 01
.9999		0.924820E 01	0.106325E 02	0.115418E 02	0.122539E 02	0.128566E 02

P	ν	0.6	0.7	0.8	0.9	1.0
.0001		0.647288E-13	0.536368E-11	0.148307E-09	0.197223E-08	0.157080E-07
.0005		0.138356E-10	0.532746E-09	0.829062E-08	0.705058E-07	0.392699E-06
.0010		0.139454E-09	0.386016E-08	0.468988E-07	0.328988E-06	0.157080E-05
.0050		0.298079E-07	0.383410E-06	0.262173E-05	0.117611E-04	0.392704E-04
.0100		0.300445E-06	0.277811E-05	0.148308E-04	0.548796E-04	0.157088E-03
.0250		0.637136E-05	0.380826E-04	0.146566E-03	0.420510E-03	0.982069E-03
.0500		0.642207E-04	0.275963E-03	0.829307E-03	0.196319E-02	0.393214E-02
.1000		0.647449E-03	0.200084E-02	0.469775E-02	0.918331E-02	0.157908E-01
.2000		0.654068E-02	0.145652E-01	0.267845E-01	0.433564E-01	0.641848E-01
.3000		0.254533E-01	0.469482E-01	0.750838E-01	0.109174E-00	0.148472E-00
.4000		0.674796E-01	0.109267E-00	0.158724E-00	0.214367E-00	0.274996E-00
.5000		0.146262E-00	0.214739E-00	0.290156E-00	0.370657E-00	0.454936E-00
.6000		0.282505E-00	0.383777E-00	0.489505E-00	0.598032E 00	0.708326E 00
.7000		0.513130E 00	0.653661E 00	0.794514E 00	0.934828E 00	0.107419E 01
.8000		0.920148E 00	0.110838E 01	0.129114E 01	0.146896E 01	0.164237E 01
.9000		0.176962E 01	0.202139E 01	0.225969E 01	0.248710E 01	0.270554E 01
.9500		0.274470E 01	0.304392E 01	0.332392E 01	0.358881E 01	0.384146E 01
.9750		0.380053E 01	0.413667E 01	0.444943E 01	0.474398E 01	0.502389E 01
.9900		0.527882E 01	0.565317E 01	0.600019E 01	0.632602E 01	0.663490E 01
.9950		0.644114E 01	0.683889E 01	0.720709E 01	0.755241E 01	0.787944E 01
.9990		0.923787E 01	0.967813E 01	0.100852E 02	0.104666E 02	0.108276E 02
.9995		0.104728E 02	0.109278E 02	0.113485E 02	0.117427E 02	0.121157E 02
.9999		0.133893E 02	0.138731E 02	0.143205E 02	0.147399E 02	0.151367E 02

PERCENTAGE POINTS OF THE CHI-SQUARE DISTRIBUTION

P	ν	1.1	1.2	1.3	1.4	1.5
.0001		0.861549E-07	0.357163E-06	0.119364E-05	0.336747E-05	0.829515E-05
.0005		0.160744E-05	0.522177E-05	0.141976E-04	0.335611E-04	0.709238E-04
.0010		0.566843E-05	0.165781E-04	0.412422E-04	0.903413E-04	0.178722E-03
.0050		0.105762E-03	0.242391E-03	0.490613E-03	0.900572E-03	0.152864E-02
.0100		0.372989E-03	0.769670E-03	0.142556E-02	0.242525E-02	0.385450E-02
.0250		0.197446E-02	0.354744E-02	0.584496E-02	0.899664E-02	0.131130E-01
.0500		0.697388E-02	0.112897E-01	0.170363E-01	0.243264E-01	0.332328E-01
.1000		0.247335E-01	0.361209E-01	0.499825E-01	0.662910E-01	0.849810E-01
.2000		0.890340E-01	0.117607E-00	0.149589E-00	0.184677E-00	0.222586E-00
.3000		0.192278E-00	0.239978E-00	0.291046E-00	0.345040E-00	0.401589E-00
.4000		0.339667E-00	0.407645E-00	0.478359E-00	0.551360E 00	0.626292E 00
.5000		0.542073E 00	0.631404E 00	0.722448E 00	0.814847E 00	0.908334E 00
.6000		0.819731E 00	0.931818E 00	0.104430E 01	0.115700E 01	0.126978E 01
.7000		0.121244E 01	0.134950E 01	0.148538E 01	0.162013E 01	0.175379E 01
.8000		0.181190E 01	0.197798E 01	0.214100E 01	0.230129E 01	0.245912E 01
.9000		0.291647E 01	0.312101E 01	0.332003E 01	0.351426E 01	0.370426E 01
.9500		0.408400E 01	0.431802E 01	0.454478E 01	0.476524E 01	0.498020E 01
.9750		0.529176E 01	0.554955E 01	0.579874E 01	0.604051E 01	0.627581E 01
.9900		0.692986E 01	0.721318E 01	0.748660E 01	0.775148E 01	0.800890E 01
.9950		0.819147E 01	0.849097E 01	0.877980E 01	0.905943E 01	0.933102E 01
.9990		0.111717E 02	0.115017E 02	0.118198E 02	0.121275E 02	0.124262E 02
.9995		0.124712E 02	0.128122E 02	0.131408E 02	0.134587E 02	0.137672E 02
.9999		0.155151E 02	0.158780E 02	0.162277E 02	0.165660E 02	0.168944E 02

P	ν	1.6	1.7	1.8	1.9	2.0
.0001		0.182997E-04	0.368620E-04	0.688306E-04	0.120566E-03	0.200010E-03
.0005		0.136826E-03	0.244862E-03	0.411580E-03	0.656211E-03	0.100025E-02
.0010		0.325447E-03	0.553490E-03	0.889173E-03	0.136143E-02	0.200100E-02
.0050		0.243471E-02	0.367955E-02	0.532263E-02	0.742041E-02	0.100251E-01
.0100		0.579615E-02	0.832707E-02	0.115163E-01	0.154238E-01	0.201007E-01
.0250		0.182839E-01	0.245789E-01	0.320486E-01	0.407274E-01	0.506356E-01
.0500		0.437951E-01	0.560263E-01	0.699189E-01	0.854503E-01	0.102587E-00
.1000		0.105964E-00	0.129137E-00	0.154393E-00	0.181624E-00	0.210721E-00
.2000		0.263057E-00	0.305858E-00	0.350783E-00	0.397647E-00	0.446287E-00
.3000		0.460384E-00	0.521161E 00	0.583702E 00	0.647818E 00	0.713350E 00
.4000		0.702871E 00	0.780867E 00	0.860094E 00	0.940398E 00	0.102185E 01
.5000		0.100270E 01	0.109779E 01	0.119349E 01	0.128968E 01	0.138629E 01
.6000		0.138254E 01	0.149524E 01	0.160783E 01	0.172028E 01	0.183258E 01
.7000		0.188643E 01	0.201811E 01	0.214888E 01	0.227881E 01	0.240795E 01
.8000		0.261474E 01	0.276836E 01	0.292015E 01	0.307028E 01	0.321888E 01
.9000		0.389052E 01	0.407343E 01	0.425332E 01	0.443049E 01	0.460517E 01
.9500		0.519029E 01	0.539605E 01	0.559792E 01	0.579629E 01	0.599146E 01
.9750		0.650539E 01	0.672989E 01	0.694983E 01	0.716566E 01	0.737776E 01
.9900		0.825976E 01	0.850477E 01	0.874454E 01	0.897959E 01	0.921034E 01
.9950		0.959554E 01	0.985375E 01	0.101063E 02	0.103538E 02	0.105966E 02
.9990		0.127169E 02	0.130005E 02	0.132778E 02	0.135492E 02	0.138155E 02
.9995		0.140675E 02	0.143604E 02	0.146466E 02	0.149269E 02	0.152018E 02
.9999		0.172139E 02	0.175255E 02	0.178301E 02	0.181283E 02	0.184207E 02

PERCENTAGE POINTS OF THE CHI-SQUARE DISTRIBUTION

P	ν	2.1	2.2	2.3	2.4	2.5
.0001		0.316675E-03	0.481566E-03	0.707046E-03	0.100666E-02	0.139492E-02
.0005		0.146697E-02	0.208089E-02	0.286725E-02	0.385157E-02	0.505917E-02
.0010		0.283963E-02	0.390932E-02	0.524169E-02	0.686743E-02	0.881588E-02
.0050		0.131838E-01	0.169385E-01	0.213252E-01	0.263750E-01	0.321134E-01
.0100		0.255868E-01	0.319216E-01	0.391249E-01	0.472174E-01	0.562121E-01
.0250		0.617817E-01	0.741649E-01	0.877765E-01	0.102602E-00	0.118623E-00
.0500		0.121286E-00	0.141504E-00	0.163188E-00	0.186290E-00	0.210758E-00
.1000		0.241582E-00	0.274109E-00	0.308210E-00	0.343797E-00	0.380789E-00
.2000		0.496559E-00	0.548335E 00	0.601500E 00	0.655952E 00	0.711599E 00
.3000		0.780160E 00	0.848131E 00	0.917160E 00	0.987156E 00	0.105804E 01
.4000		0.110375E 01	0.118660E 01	0.127012E 01	0.135425E 01	0.143894E 01
.5000		0.148327E 01	0.158055E 01	0.167810E 01	0.177587E 01	0.187385E 01
.6000		0.194471E 01	0.205667E 01	0.216846E 01	0.228007E 01	0.239150E 01
.7000		0.253634E 01	0.266403E 01	0.279107E 01	0.291749E 01	0.304333E 01
.8000		0.336606E 01	0.351195E 01	0.365662E 01	0.380018E 01	0.394268E 01
.9000		0.477758E 01	0.494791E 01	0.511630E 01	0.528292E 01	0.544788E 01
.9500		0.618373E 01	0.637333E 01	0.656047E 01	0.674533E 01	0.692808E 01
.9750		0.758645E 01	0.779202E 01	0.799471E 01	0.819474E 01	0.839230E 01
.9900		0.943718E 01	0.966042E 01	0.988035E 01	0.100972E 02	0.103112E 02
.9950		0.108352E 02	0.110700E 02	0.113011E 02	0.115290E 02	0.117538E 02
.9990		0.140770E 02	0.143341E 02	0.145871E 02	0.148364E 02	0.150822E 02
.9995		0.154717E 02	0.157370E 02	0.159981E 02	0.162553E 02	0.165089E 02
.9999		0.187077E 02	0.189899E 02	0.192675E 02	0.195409E 02	0.198104E 02
P	ν	2.6	2.7	2.8	2.9	3.0
.0001		0.188710E-02	0.249901E-02	0.324678E-02	0.414666E-02	0.521483E-02
.0005		0.651481E-02	0.824242E-02	0.102648E-01	0.126036E-01	0.152790E-01
.0010		0.111147E-01	0.137896E-01	0.168644E-01	0.203605E-01	0.242976E-01
.0050		0.385615E-01	0.457355E-01	0.536482E-01	0.623083E-01	0.717218E-01
.0100		0.661161E-01	0.769326E-01	0.886606E-01	0.101296E-00	0.114832E-00
.0250		0.135816E-00	0.154157E-00	0.173619E-00	0.194175E-00	0.215795E-00
.0500		0.236541E-00	0.263589E-00	0.291853E-00	0.321287E-00	0.351846E-00
.1000		0.419112E-00	0.458695E-00	0.499473E-00	0.541385E 00	0.584374E 00
.2000		0.768361E 00	0.826162E 00	0.884938E 00	0.944626E 00	0.100517E 01
.3000		0.112975E 01	0.120221E 01	0.127539E 01	0.134921E 01	0.142365E 01
.4000		0.152413E 01	0.160979E 01	0.169587E 01	0.178234E 01	0.186917E 01
.5000		0.197200E 01	0.207030E 01	0.216874E 01	0.226730E 01	0.236597E 01
.6000		0.250277E 01	0.261386E 01	0.272479E 01	0.283556E 01	0.294617E 01
.7000		0.316862E 01	0.329340E 01	0.341768E 01	0.354150E 01	0.366487E 01
.8000		0.408420E 01	0.422481E 01	0.436455E 01	0.450347E 01	0.464163E 01
.9000		0.561130E 01	0.577327E 01	0.593389E 01	0.609324E 01	0.625139E 01
.9500		0.710866E 01	0.728780E 01	0.746503E 01	0.764064E 01	0.781473E 01
.9750		0.858755E 01	0.878067E 01	0.897176E 01	0.916097E 01	0.934840E 01
.9900		0.105226E 02	0.107315E 02	0.109381E 02	0.111425E 02	0.113449E 02
.9950		0.119757E 02	0.121949E 02	0.124116E 02	0.126260E 02	0.128382E 02
.9990		0.153247E 02	0.155642E 02	0.158009E 02	0.160348E 02	0.162662E 02
.9995		0.167591E 02	0.170061E 02	0.172502E 02	0.174914E 02	0.177300E 02
.9999		0.200763E 02	0.203387E 02	0.205979E 02	0.208542E 02	0.211075E 02

PERCENTAGE POINTS OF THE CHI-SQUARE DISTRIBUTION

P v	3.1	3.2	3.3	3.4	3.5
.0001	0.646729E-02	0.791963E-02	0.958702E-02	0.114840E-01	0.136246E-01
.0005	0.183096E-01	0.217126E-01	0.255038E-01	0.296973E-01	0.343058E-01
.0010	0.286929E-01	0.335617E-01	0.389175E-01	0.447717E-01	0.511340E-01
.0050	0.818915E-01	0.928181E-01	0.104500E-00	0.116934E-00	0.130116E-00
.0100	0.129259E-00	0.144568E-00	0.160745E-00	0.177777E-00	0.195651E-00
.0250	0.238452E-00	0.262116E-00	0.286760E-00	0.312355E-00	0.338873E-00
.0500	0.383487E-00	0.416168E-00	0.449850E-00	0.484495E-00	0.520069E 00
.1000	0.628389E 00	0.673381E 00	0.719304E 00	0.766116E 00	0.813778E 00
.2000	0.106653E 01	0.112865E 01	0.119149E 01	0.125502E 01	0.131920E 01
.3000	0.149867E 01	0.157422E 01	0.165027E 01	0.172681E 01	0.180379E 01
.4000	0.195634E 01	0.204382E 01	0.213160E 01	0.221964E 01	0.230795E 01
.5000	0.246474E 01	0.256359E 01	0.266252E 01	0.276152E 01	0.286059E 01
.6000	0.305662E 01	0.316694E 01	0.327710E 01	0.338713E 01	0.349703E 01
.7000	0.378763E 01	0.391038E 01	0.403256E 01	0.415437E 01	0.427583E 01
.8000	0.477906E 01	0.491580E 01	0.505188E 01	0.518735E 01	0.532222E 01
.9000	0.640841E 01	0.656437E 01	0.671931E 01	0.687329E 01	0.702636E 01
.9500	0.798736E 01	0.815868E 01	0.832869E 01	0.849749E 01	0.866512E 01
.9750	0.953416E 01	0.971832E 01	0.990099E 01	0.100822E 02	0.102621E 02
.9900	0.115453E 02	0.117439E 02	0.119407E 02	0.121359E 02	0.123296E 02
.9950	0.130482E 02	0.132563E 02	0.134625E 02	0.136669E 02	0.138696E 02
.9990	0.164953E 02	0.167220E 02	0.169466E 02	0.171692E 02	0.173899E 02
.9995	0.179661E 02	0.181998E 02	0.184313E 02	0.186607E 02	0.188880E 02
.9999	0.213582E 02	0.216063E 02	0.218520E 02	0.220954E 02	0.223365E 02

P v	3.6	3.7	3.8	3.9	4.0
.0001	0.160220E-01	0.186887E-01	0.216365E-01	0.248764E-01	0.284185E-01
.0005	0.393405E-01	0.448115E-01	0.507273E-01	0.570954E-01	0.639220E-01
.0010	0.580128E-01	0.654145E-01	0.733444E-01	0.818067E-01	0.908040E-01
.0050	0.144039E-00	0.158696E-00	0.174079E-00	0.190180E-00	0.206989E-00
.0100	0.214351E-00	0.233863E-00	0.254170E-00	0.275258E-00	0.297109E-00
.0250	0.366289E-00	0.394577E-00	0.423710E-00	0.453665E-00	0.484419E-00
.0500	0.556536E 00	0.593865E 00	0.632025E 00	0.670987E 00	0.710723E 00
.1000	0.862253E 00	0.911506E 00	0.961505E 00	0.101222E 01	0.106362E 01
.2000	0.138399E 01	0.144937E 01	0.151531E 01	0.158179E 01	0.164878E 01
.3000	0.188121E 01	0.195902E 01	0.203722E 01	0.211579E 01	0.219470E 01
.4000	0.239650E 01	0.248527E 01	0.257426E 01	0.266346E 01	0.275284E 01
.5000	0.295971E 01	0.305889E 01	0.315811E 01	0.325738E 01	0.335669E 01
.6000	0.360679E 01	0.371643E 01	0.382595E 01	0.393534E 01	0.404463E 01
.7000	0.439696E 01	0.451777E 01	0.463828E 01	0.475850E 01	0.487843E 01
.8000	0.545653E 01	0.559030E 01	0.572356E 01	0.585632E 01	0.598862E 01
.9000	0.717856E 01	0.732994E 01	0.748052E 01	0.763034E 01	0.777944E 01
.9500	0.883165E 01	0.899714E 01	0.916161E 01	0.932513E 01	0.948773E 01
.9750	0.104407E 02	0.106181E 02	0.107942E 02	0.109693E 02	0.111433E 02
.9900	0.125217E 02	0.127124E 02	0.129018E 02	0.130899E 02	0.132767E 02
.9950	0.140707E 02	0.142702E 02	0.144683E 02	0.146650E 02	0.148603E 02
.9990	0.176086E 02	0.178257E 02	0.180410E 02	0.182547E 02	0.184668E 02
.9995	0.191134E 02	0.193370E 02	0.195588E 02	0.197789E 02	0.199974E 02
.9999	0.225756E 02	0.228127E 02	0.230479E 02	0.232812E 02	0.235127E 02

PERCENTAGE POINTS OF THE CHI-SQUARE DISTRIBUTION

P ν	4.1	4.2	4.3	4.4	4.5
.0001	0.322722E-01	0.364463E-01	0.409487E-01	0.457865E-01	0.509662E-01
.0005	0.712126E-01	0.789712E-01	0.872013E-01	0.959054E-01	0.105085E-00
.0010	0.100338E-00	0.110410E-00	0.121020E-00	0.132168E-00	0.143850E-00
.0050	0.224496E-00	0.242691E-00	0.261564E-00	0.281104E-00	0.301300E-00
.0100	0.319710E-00	0.343044E-00	0.367095E-00	0.391849E-00	0.417290E-00
.0250	0.515947E 00	0.548228E 00	0.581242E 00	0.614967E 00	0.649385E 00
.0500	0.751207E 00	0.792415E 00	0.834321E 00	0.876904E 00	0.920143E 00
.1000	0.111569E 01	0.116839E 01	0.122170E 01	0.127560E 01	0.133007E 01
.2000	0.171625E 01	0.178420E 01	0.185259E 01	0.192141E 01	0.199065E 01
.3000	0.227394E 01	0.235350E 01	0.243337E 01	0.251352E 01	0.259395E 01
.4000	0.284241E 01	0.293216E 01	0.302207E 01	0.311213E 01	0.320235E 01
.5000	0.345604E 01	0.355542E 01	0.365484E 01	0.375428E 01	0.385375E 01
.6000	0.415380E 01	0.426286E 01	0.437182E 01	0.448068E 01	0.458944E 01
.7000	0.499810E 01	0.511750E 01	0.523666E 01	0.535557E 01	0.547425E 01
.8000	0.612046E 01	0.625186E 01	0.638285E 01	0.651343E 01	0.664363E 01
.9000	0.792705E 01	0.807559E 01	0.822268E 01	0.836917E 01	0.851506E 01
.9500	0.964945E 01	0.981032E 01	0.997038E 01	0.101297E 02	0.102882E 02
.9750	0.113162E 02	0.114882E 02	0.116592E 02	0.118293E 02	0.119985E 02
.9900	0.134623E 02	0.136468E 02	0.138302E 02	0.140125E 02	0.141938E 02
.9950	0.150543E 02	0.152470E 02	0.154386E 02	0.156290E 02	0.158183E 02
.9990	0.186775E 02	0.188867E 02	0.190946E 02	0.193011E 02	0.195064E 02
.9995	0.202143E 02	0.204297E 02	0.206437E 02	0.208563E 02	0.210675E 02
.9999	0.237426E 02	0.239709E 02	0.241975E 02	0.244227E 02	0.246464E 02

P ν	4.6	4.7	4.8	4.9	5.0
.0001	0.564938E-01	0.623744E-01	0.686126E-01	0.752124E-01	0.821774E-01
.0005	0.114742E-00	0.124876E-00	0.135487E-00	0.146575E-00	0.158138E-00
.0010	0.156067E-00	0.168815E-00	0.182091E-00	0.195891E-00	0.210213E-00
.0050	0.322141E-00	0.343617E-00	0.365716E-00	0.388428E-00	0.411742E-00
.0100	0.443403E-00	0.470175E-00	0.497590E-00	0.525636E 00	0.554298E 00
.0250	0.684475E 00	0.720220E 00	0.756602E 00	0.793605E 00	0.831212E 00
.0500	0.964015E 00	0.100850E 01	0.105359E 01	0.109925E 01	0.114548E 01
.1000	0.138509E 01	0.144064E 01	0.149671E 01	0.155327E 01	0.161031E 01
.2000	0.206029E 01	0.213031E 01	0.220070E 01	0.227144E 01	0.234253E 01
.3000	0.267465E 01	0.275560E 01	0.283680E 01	0.291824E 01	0.299991E 01
.4000	0.329272E 01	0.338322E 01	0.347385E 01	0.356461E 01	0.365550E 01
.5000	0.395325E 01	0.405277E 01	0.415231E 01	0.425188E 01	0.435146E 01
.6000	0.469811E 01	0.480668E 01	0.491516E 01	0.502356E 01	0.513187E 01
.7000	0.559271E 01	0.571095E 01	0.582897E 01	0.594680E 01	0.606443E 01
.8000	0.677346E 01	0.690292E 01	0.703204E 01	0.716082E 01	0.728928E 01
.9000	0.866038E 01	0.880515E 01	0.894940E 01	0.909312E 01	0.923636E 01
.9500	0.104460E 02	0.106031E 02	0.107596E 02	0.109153E 02	0.110705E 02
.9750	0.121669E 02	0.123345E 02	0.125012E 02	0.126672E 02	0.128325E 02
.9900	0.143741E 02	0.145535E 02	0.147320E 02	0.149096E 02	0.150863E 02
.9950	0.160066E 02	0.161938E 02	0.163800E 02	0.165653E 02	0.167496E 02
.9990	0.197104E 02	0.199132E 02	0.201149E 02	0.203155E 02	0.205150E 02
.9995	0.212775E 02	0.214862E 02	0.216937E 02	0.219001E 02	0.221053E 02
.9999	0.248687E 02	0.250897E 02	0.253093E 02	0.255277E 02	0.257448E 02

PERCENTAGE POINTS OF THE CHI-SQUARE DISTRIBUTION

P	ν	5.1	5.2	5.3	5.4	5.5
.0001		0.895105E-01	0.972142E-01	0.105291E-00	0.113741E-00	0.122568E-00
.0005		0.170174E-00	0.182683E-00	0.195661E-00	0.209106E-00	0.223015E-00
.0010		0.225051E-00	0.240402E-00	0.256260E-00	0.272622E-00	0.289481E-00
.0050		0.435647E-00	0.460133E-00	0.485190E-00	0.510807E 00	0.536975E 00
.0100		0.583564E 00	0.613420E 00	0.643853E 00	0.674853E 00	0.706407E 00
.0250		0.869407E 00	0.908176E 00	0.947504E 00	0.987377E 00	0.102778E 01
.0500		0.119225E 01	0.123955E 01	0.128736E 01	0.133568E 01	0.138448E 01
.1000		0.166781E 01	0.172577E 01	0.178416E 01	0.184298E 01	0.190221E 01
.2000		0.241396E 01	0.248570E 01	0.255776E 01	0.263012E 01	0.270277E 01
.3000		0.308180E 01	0.316389E 01	0.324620E 01	0.332870E 01	0.341140E 01
.4000		0.374650E 01	0.383762E 01	0.392884E 01	0.402016E 01	0.411160E 01
.5000		0.445106E 01	0.455068E 01	0.465031E 01	0.474996E 01	0.484962E 01
.6000		0.524009E 01	0.534824E 01	0.545631E 01	0.556430E 01	0.567222E 01
.7000		0.618187E 01	0.629912E 01	0.641620E 01	0.653310E 01	0.664984E 01
.8000		0.741742E 01	0.754526E 01	0.767280E 01	0.780006E 01	0.792704E 01
.9000		0.937911E 01	0.952140E 01	0.966324E 01	0.980465E 01	0.994563E 01
.9500		0.112250E 02	0.113790E 02	0.115324E 02	0.116852E 02	0.118376E 02
.9750		0.129971E 02	0.131609E 02	0.133241E 02	0.134867E 02	0.136486E 02
.9900		0.152622E 02	0.154373E 02	0.156116E 02	0.157851E 02	0.159580E 02
.9950		0.169330E 02	0.171156E 02	0.172973E 02	0.174782E 02	0.176583E 02
.9990		0.207135E 02	0.209109E 02	0.211074E 02	0.213030E 02	0.214976E 02
.9995		0.223095E 02	0.225126E 02	0.227146E 02	0.229157E 02	0.231158E 02
.9999		0.259608E 02	0.261756E 02	0.263893E 02	0.266019E 02	0.268134E 02
P	ν	5.6	5.7	5.8	5.9	6.0
.0001		0.131770E-00	0.141350E-00	0.151307E-00	0.161641E-00	0.172352E-00
.0005		0.237385E-00	0.252213E-00	0.267495E-00	0.283228E-00	0.299408E-00
.0010		0.306834E-00	0.324674E-00	0.342997E-00	0.361796E-00	0.381067E-00
.0050		0.563682E 00	0.590921E 00	0.618681E 00	0.646952E 00	0.675727E 00
.0100		0.738503E 00	0.771130E 00	0.804277E 00	0.837934E 00	0.872090E 00
.0250		0.106870E 01	0.111013E 01	0.115206E 01	0.119447E 01	0.123734E 01
.0500		0.143376E 01	0.148350E 01	0.153370E 01	0.158433E 01	0.163538E 01
.1000		0.196184E 01	0.202185E 01	0.208225E 01	0.214301E 01	0.220413E 01
.2000		0.277570E 01	0.284890E 01	0.292238E 01	0.299611E 01	0.307009E 01
.3000		0.349428E 01	0.357734E 01	0.366058E 01	0.374398E 01	0.382755E 01
.4000		0.420313E 01	0.429475E 01	0.438646E 01	0.447826E 01	0.457015E 01
.5000		0.494930E 01	0.504899E 01	0.514869E 01	0.524840E 01	0.534812E 01
.6000		0.578006E 01	0.588784E 01	0.599555E 01	0.610318E 01	0.621076E 01
.7000		0.676641E 01	0.688282E 01	0.699907E 01	0.711518E 01	0.723114E 01
.8000		0.805375E 01	0.818020E 01	0.830640E 01	0.843235E 01	0.855806E 01
.9000		0.100862E 02	0.102264E 02	0.103662E 02	0.105056E 02	0.106446E 02
.9500		0.119893E 02	0.121406E 02	0.122914E 02	0.124417E 02	0.125916E 02
.9750		0.138099E 02	0.139706E 02	0.141308E 02	0.142903E 02	0.144494E 02
.9900		0.161301E 02	0.163015E 02	0.164723E 02	0.166424E 02	0.168119E 02
.9950		0.178376E 02	0.180162E 02	0.181940E 02	0.183711E 02	0.185476E 02
.9990		0.216913E 02	0.218842E 02	0.220762E 02	0.222674E 02	0.224577E 02
.9995		0.233150E 02	0.235132E 02	0.237106E 02	0.239071E 02	0.241028E 02
.9999		0.270240E 02	0.272335E 02	0.274420E 02	0.276497E 02	0.278563E 02

PERCENTAGE POINTS OF THE CHI-SQUARE DISTRIBUTION

P ν	6.1	6.2	6.3	6.4	6.5
.0001	0.183439E-00	0.194902E-00	0.206740E-00	0.218950E-00	0.231533E-00
.0005	0.316030E-00	0.333091E-00	0.350587E-00	0.368514E-00	0.386866E-00
.0010	0.400804E-00	0.421001E-00	0.441653E-00	0.462755E-00	0.484300E-00
.0050	0.704995E 00	0.734749E 00	0.764979E 00	0.795677E 00	0.826835E 00
.0100	0.906736E 00	0.941861E 00	0.977456E 00	0.101351E 01	0.105002E 01
.0250	0.128068E 01	0.132447E 01	0.136870E 01	0.141336E 01	0.145845E 01
.0500	0.168686E 01	0.173874E 01	0.179102E 01	0.184369E 01	0.189673E 01
.1000	0.226560E 01	0.232741E 01	0.238954E 01	0.245200E 01	0.251478E 01
.2000	0.314431E 01	0.321878E 01	0.329347E 01	0.336839E 01	0.344353E 01
.3000	0.391128E 01	0.399516E 01	0.407920E 01	0.416338E 01	0.424770E 01
.4000	0.466213E 01	0.475418E 01	0.484631E 01	0.493851E 01	0.503079E 01
.5000	0.544785E 01	0.554759E 01	0.564734E 01	0.574710E 01	0.584687E 01
.6000	0.631827E 01	0.642571E 01	0.653310E 01	0.664043E 01	0.674769E 01
.7000	0.734695E 01	0.746263E 01	0.757817E 01	0.769358E 01	0.780886E 01
.8000	0.868354E 01	0.880878E 01	0.893381E 01	0.905862E 01	0.918323E 01
.9000	0.107833E 02	0.109217E 02	0.110597E 02	0.111974E 02	0.113347E 02
.9500	0.127410E 02	0.128900E 02	0.130385E 02	0.131866E 02	0.133343E 02
.9750	0.146079E 02	0.147659E 02	0.149234E 02	0.150804E 02	0.152369E 02
.9900	0.169808E 02	0.171490E 02	0.173167E 02	0.174838E 02	0.176504E 02
.9950	0.187234E 02	0.188985E 02	0.190730E 02	0.192468E 02	0.194201E 02
.9990	0.226474E 02	0.228362E 02	0.230243E 02	0.232117E 02	0.233984E 02
.9995	0.242977E 02	0.244917E 02	0.246850E 02	0.248775E 02	0.250693E 02
.9999	0.280621E 02	0.282671E 02	0.284711E 02	0.286744E 02	0.288768E 02

P ν	6.6	6.7	6.8	6.9	7.0
.0001	0.244486E-00	0.257808E-00	0.271496E-00	0.285550E-00	0.299967E-00
.0005	0.405641E-00	0.424834E-00	0.444440E-00	0.464455E-00	0.484875E-00
.0010	0.506284E 00	0.528700E 00	0.551545E 00	0.574811E 00	0.598494E 00
.0050	0.858446E 00	0.890501E 00	0.922992E 00	0.955913E 00	0.989256E 00
.0100	0.108697E 01	0.112436E 01	0.116217E 01	0.120040E 01	0.123904E 01
.0250	0.150394E 01	0.154984E 01	0.159613E 01	0.164281E 01	0.168987E 01
.0500	0.195015E 01	0.200393E 01	0.205806E 01	0.211253E 01	0.216735E 01
.1000	0.257786E 01	0.264124E 01	0.270491E 01	0.276887E 01	0.283311E 01
.2000	0.351868E 01	0.359444E 01	0.367021E 01	0.374617E 01	0.382232E 01
.3000	0.433216E 01	0.441676E 01	0.450149E 01	0.458635E 01	0.467133E 01
.4000	0.512315E 01	0.521557E 01	0.530806E 01	0.540061E 01	0.549324E 01
.5000	0.594664E 01	0.604643E 01	0.614621E 01	0.624601E 01	0.634581E 01
.6000	0.685491E 01	0.696206E 01	0.706916E 01	0.717621E 01	0.728321E 01
.7000	0.792401E 01	0.803904E 01	0.815396E 01	0.826875E 01	0.838343E 01
.8000	0.930762E 01	0.943182E 01	0.955582E 01	0.967963E 01	0.980325E 01
.9000	0.114718E 02	0.116085E 02	0.117450E 02	0.118812E 02	0.120170E 02
.9500	0.134816E 02	0.136286E 02	0.137751E 02	0.139213E 02	0.140671E 02
.9750	0.153930E 02	0.155486E 02	0.157037E 02	0.158585E 02	0.160128E 02
.9900	0.178164E 02	0.179819E 02	0.181469E 02	0.183113E 02	0.184753E 02
.9950	0.195927E 02	0.197648E 02	0.199363E 02	0.201073E 02	0.202777E 02
.9990	0.235844E 02	0.237698E 02	0.239544E 02	0.241385E 02	0.243219E 02
.9995	0.252604E 02	0.254507E 02	0.256404E 02	0.258294E 02	0.260178E 02
.9999	0.290785E 02	0.292793E 02	0.294795E 02	0.296788E 02	0.298775E 02

PERCENTAGE POINTS OF THE CHI-SQUARE DISTRIBUTION

P	ν	7.1	7.2	7.3	7.4	7.5
.0001		0.314744E-00	0.329881E-00	0.345373E-00	0.361220E-00	0.377418E-00
.0005		0.505695E 00	0.526911E 00	0.548519E 00	0.570514E 00	0.592892E 00
.0010		0.622588E 00	0.647089E 00	0.671990E 00	0.697287E 00	0.722975E 00
.0050		0.102301E 01	0.105718E 01	0.109175E 01	0.112671E 01	0.116206E 01
.0100		0.127809E 01	0.131753E 01	0.135736E 01	0.139757E 01	0.143816E 01
.0250		0.173730E 01	0.178509E 01	0.183324E 01	0.188174E 01	0.193059E 01
.0500		0.222250E 01	0.227797E 01	0.233376E 01	0.238986E 01	0.244626E 01
.1000		0.289762E 01	0.296239E 01	0.302743E 01	0.309272E 01	0.315826E 01
.2000		0.389867E 01	0.397519E 01	0.405190E 01	0.412878E 01	0.420584E 01
.3000		0.475643E 01	0.484166E 01	0.492700E 01	0.501245E 01	0.509802E 01
.4000		0.558592E 01	0.567866E 01	0.577146E 01	0.586433E 01	0.595725E 01
.5000		0.644562E 01	0.654543E 01	0.664525E 01	0.674508E 01	0.684491E 01
.6000		0.739015E 01	0.749705E 01	0.760389E 01	0.771069E 01	0.781744E 01
.7000		0.849800E 01	0.861246E 01	0.872681E 01	0.884106E 01	0.895520E 01
.8000		0.992669E 01	0.100500E 02	0.101730E 02	0.102960E 02	0.104187E 02
.9000		0.121526E 02	0.122880E 02	0.124230E 02	0.125578E 02	0.126924E 02
.9500		0.142126E 02	0.143577E 02	0.145025E 02	0.146470E 02	0.147912E 02
.9750		0.161667E 02	0.163201E 02	0.164732E 02	0.166260E 02	0.167783E 02
.9900		0.186388E 02	0.188018E 02	0.189644E 02	0.191265E 02	0.192882E 02
.9950		0.204476E 02	0.206170E 02	0.207859E 02	0.209543E 02	0.211222E 02
.9990		0.245047E 02	0.246869E 02	0.248685E 02	0.250496E 02	0.252301E 02
.9995		0.262055E 02	0.263925E 02	0.265790E 02	0.267649E 02	0.269501E 02
.9999		0.300755E 02	0.302727E 02	0.304693E 02	0.306652E 02	0.308605E 02
P	ν	7.6	7.7	7.8	7.9	8.0
.0001		0.393965E-00	0.410859E-00	0.428097E-00	0.445676E-00	0.463594E-00
.0005		0.615649E 00	0.638780E 00	0.662282E 00	0.686150E 00	0.710379E 00
.0010		0.749049E 00	0.775504E 00	0.802335E 00	0.829537E 00	0.857105E 00
.0050		0.119779E 01	0.123390E 01	0.127037E 01	0.130721E 01	0.134441E 01
.0100		0.147911E 01	0.152043E 01	0.156211E 01	0.160413E 01	0.164650E 01
.0250		0.197977E 01	0.202928E 01	0.207911E 01	0.212927E 01	0.217973E 01
.0500		0.250296E 01	0.255996E 01	0.261724E 01	0.267480E 01	0.273264E 01
.1000		0.322405E 01	0.329007E 01	0.335633E 01	0.342282E 01	0.348954E 01
.2000		0.428306E 01	0.436045E 01	0.443800E 01	0.451571E 01	0.459357E 01
.3000		0.518369E 01	0.526947E 01	0.535535E 01	0.544134E 01	0.552742E 01
.4000		0.605022E 01	0.614325E 01	0.623633E 01	0.632946E 01	0.642264E 01
.5000		0.694474E 01	0.704458E 01	0.714442E 01	0.724427E 01	0.734412E 01
.6000		0.792415E 01	0.803081E 01	0.813742E 01	0.824400E 01	0.835053E 01
.7000		0.906925E 01	0.918319E 01	0.929704E 01	0.941080E 01	0.952446E 01
.8000		0.105413E 02	0.106637E 02	0.107860E 02	0.109081E 02	0.110301E 02
.9000		0.128267E 02	0.129608E 02	0.130946E 02	0.132282E 02	0.133616E 02
.9500		0.149350E 02	0.150785E 02	0.152217E 02	0.153647E 02	0.155073E 02
.9750		0.169303E 02	0.170819E 02	0.172331E 02	0.173840E 02	0.175345E 02
.9900		0.194494E 02	0.196102E 02	0.197706E 02	0.199306E 02	0.200902E 02
.9950		0.212897E 02	0.214567E 02	0.216232E 02	0.217893E 02	0.219550E 02
.9990		0.254100E 02	0.255894E 02	0.257683E 02	0.259466E 02	0.261245E 02
.9995		0.271348E 02	0.273189E 02	0.275025E 02	0.276855E 02	0.278680E 02
.9999		0.310552E 02	0.312492E 02	0.314426E 02	0.316354E 02	0.318276E 02

PERCENTAGE POINTS OF THE CHI-SQUARE DISTRIBUTION

P	ν	8.1	8.2	8.3	8.4	8.5
.0001		0.481848E-00	0.500435E 00	0.519353E 00	0.538599E 00	0.558170E 00
.0005		0.734967E 00	0.759908E 00	0.785199E 00	0.810835E 00	0.836814E 00
.0010		0.885035E 00	0.913322E 00	0.941962E 00	0.970950E 00	0.100028E 01
.0050		0.138196E 01	0.141986E 01	0.145810E 01	0.149668E 01	0.153559E 01
.0100		0.168920E 01	0.173224E 01	0.177561E 01	0.181930E 01	0.186330E 01
.0250		0.223050E 01	0.228157E 01	0.233294E 01	0.238460E 01	0.243655E 01
.0500		0.279075E 01	0.284912E 01	0.290775E 01	0.296664E 01	0.302579E 01
.1000		0.355647E 01	0.362363E 01	0.369099E 01	0.375856E 01	0.382634E 01
.2000		0.467159E 01	0.474975E 01	0.482806E 01	0.490651E 01	0.498510E 01
.3000		0.561360E 01	0.569986E 01	0.578625E 01	0.587271E 01	0.595926E 01
.4000		0.651588E 01	0.660916E 01	0.670249E 01	0.679586E 01	0.688928E 01
.5000		0.744398E 01	0.754384E 01	0.764370E 01	0.774357E 01	0.784344E 01
.6000		0.845701E 01	0.856346E 01	0.866987E 01	0.877623E 01	0.888256E 01
.7000		0.963803E 01	0.975151E 01	0.986491E 01	0.997822E 01	0.100914E 02
.8000		0.111519E 02	0.112736E 02	0.113951E 02	0.115165E 02	0.116378E 02
.9000		0.134947E 02	0.136276E 02	0.137603E 02	0.138929E 02	0.140251E 02
.9500		0.156497E 02	0.157917E 02	0.159336E 02	0.160751E 02	0.162164E 02
.9750		0.176848E 02	0.178347E 02	0.179842E 02	0.181335E 02	0.182825E 02
.9900		0.202494E 02	0.204083E 02	0.205667E 02	0.207248E 02	0.208825E 02
.9950		0.221202E 02	0.222850E 02	0.224494E 02	0.226134E 02	0.227770E 02
.9990		0.263018E 02	0.264787E 02	0.266551E 02	0.268310E 02	0.270065E 02
.9995		0.280500E 02	0.282315E 02	0.284124E 02	0.285929E 02	0.287729E 02
.9999		0.320193E 02	0.322104E 02	0.324009E 02	0.325909E 02	0.327803E 02

P	ν	8.6	8.7	8.8	8.9	9.0
.0001		0.578064E 00	0.598277E 00	0.618808E 00	0.639653E 00	0.660809E 00
.0005		0.863130E 00	0.889781E 00	0.916762E 00	0.944069E 00	0.971699E 00
.0010		0.102995E 01	0.105996E 01	0.109030E 01	0.112096E 01	0.115195E 01
.0050		0.157482E 01	0.161438E 01	0.165425E 01	0.169444E 01	0.173493E 01
.0100		0.190762E 01	0.195224E 01	0.199716E 01	0.204239E 01	0.208790E 01
.0250		0.248877E 01	0.254127E 01	0.259405E 01	0.264709E 01	0.270039E 01
.0500		0.308518E 01	0.314481E 01	0.320468E 01	0.326478E 01	0.332511E 01
.1000		0.389432E 01	0.396249E 01	0.403086E 01	0.409942E 01	0.416816E 01
.2000		0.506382E 01	0.514269E 01	0.522168E 01	0.530080E 01	0.538005E 01
.3000		0.604590E 01	0.613263E 01	0.621944E 01	0.630633E 01	0.639331E 01
.4000		0.698275E 01	0.707626E 01	0.716981E 01	0.726340E 01	0.735703E 01
.5000		0.794331E 01	0.804319E 01	0.814307E 01	0.824295E 01	0.834283E 01
.6000		0.898885E 01	0.909510E 01	0.920132E 01	0.930750E 01	0.941364E 01
.7000		0.102046E 02	0.103177E 02	0.104306E 02	0.105435E 02	0.106564E 02
.8000		0.117589E 02	0.118799E 02	0.120008E 02	0.121215E 02	0.122421E 02
.9000		0.141572E 02	0.142891E 02	0.144208E 02	0.145523E 02	0.146837E 02
.9500		0.163574E 02	0.164981E 02	0.166387E 02	0.167789E 02	0.169190E 02
.9750		0.184311E 02	0.185794E 02	0.187275E 02	0.188753E 02	0.190228E 02
.9900		0.210399E 02	0.211969E 02	0.213536E 02	0.215100E 02	0.216660E 02
.9950		0.229402E 02	0.231031E 02	0.232655E 02	0.234276E 02	0.235893E 02
.9990		0.271815E 02	0.273561E 02	0.275302E 02	0.277039E 02	0.278772E 02
.9995		0.289524E 02	0.291314E 02	0.293100E 02	0.294881E 02	0.296658E 02
.9999		0.329693E 02	0.331577E 02	0.333456E 02	0.335330E 02	0.337199E 02

PERCENTAGE POINTS OF THE CHI-SQUARE DISTRIBUTION

P	ν	9.1	9.2	9.3	9.4	9.5
.0001		0.682274E 00	0.704046E 00	0.726121E 00	0.748497E 00	0.771171E 00
.0005		0.999649E 00	0.102791E 01	0.105649E 01	0.108538E 01	0.111457E 01
.0010		0.118326E 01	0.121488E 01	0.124681E 01	0.127905E 01	0.131159E 01
.0050		0.177573E 01	0.181682E 01	0.185821E 01	0.189989E 01	0.194186E 01
.0100		0.213370E 01	0.217979E 01	0.222616E 01	0.227280E 01	0.231971E 01
.0250		0.275395E 01	0.280777E 01	0.286183E 01	0.291614E 01	0.297070E 01
.0500		0.338567E 01	0.344645E 01	0.350746E 01	0.356867E 01	0.363010E 01
.1000		0.423709E 01	0.430619E 01	0.437548E 01	0.444494E 01	0.451456E 01
.2000		0.545943E 01	0.553893E 01	0.561854E 01	0.569828E 01	0.577813E 01
.3000		0.648036E 01	0.656749E 01	0.665470E 01	0.674199E 01	0.682935E 01
.4000		0.745071E 01	0.754442E 01	0.763818E 01	0.773197E 01	0.782579E 01
.5000		0.844272E 01	0.854261E 01	0.864250E 01	0.874240E 01	0.884230E 01
.6000		0.951975E 01	0.962582E 01	0.973186E 01	0.983787E 01	0.994384E 01
.7000		0.107691E 02	0.108818E 02	0.109944E 02	0.111069E 02	0.112194E 02
.8000		0.123626E 02	0.124830E 02	0.126033E 02	0.127234E 02	0.128435E 02
.9000		0.148148E 02	0.149457E 02	0.150765E 02	0.152071E 02	0.153375E 02
.9500		0.170588E 02	0.171983E 02	0.173377E 02	0.174768E 02	0.176157E 02
.9750		0.191700E 02	0.193169E 02	0.194636E 02	0.196100E 02	0.197562E 02
.9900		0.218217E 02	0.219771E 02	0.221321E 02	0.222869E 02	0.224413E 02
.9950		0.237507E 02	0.239118E 02	0.240725E 02	0.242328E 02	0.243928E 02
.9990		0.280500E 02	0.282225E 02	0.283946E 02	0.285662E 02	0.287375E 02
.9995		0.298431E 02	0.300199E 02	0.301963E 02	0.303723E 02	0.305478E 02
.9999		0.339064E 02	0.340924E 02	0.342779E 02	0.344629E 02	0.346475E 02

P	ν	9.6	9.7	9.8	9.9	10.0
.0001		0.794140E 00	0.817403E 00	0.840955E 00	0.864795E 00	0.888920E 00
.0005		0.114406E 01	0.117385E 01	0.120394E 01	0.123432E 01	0.126498E 01
.0010		0.134443E 01	0.137758E 01	0.141101E 01	0.144473E 01	0.147874E 01
.0050		0.198411E 01	0.202664E 01	0.206944E 01	0.211252E 01	0.215586E 01
.0100		0.236689E 01	0.241434E 01	0.246204E 01	0.251000E 01	0.255821E 01
.0250		0.302549E 01	0.308052E 01	0.313577E 01	0.319126E 01	0.324697E 01
.0500		0.369174E 01	0.375358E 01	0.381562E 01	0.387786E 01	0.394030E 01
.1000		0.458436E 01	0.465433E 01	0.472445E 01	0.479474E 01	0.486518E 01
.2000		0.585810E 01	0.593818E 01	0.601837E 01	0.609867E 01	0.617908E 01
.3000		0.691678E 01	0.700429E 01	0.709186E 01	0.717951E 01	0.726722E 01
.4000		0.791966E 01	0.801356E 01	0.810750E 01	0.820147E 01	0.829547E 01
.5000		0.894220E 01	0.904210E 01	0.914200E 01	0.924191E 01	0.934182E 01
.6000		0.100498E 02	0.101557E 02	0.102616E 02	0.103674E 02	0.104732E 02
.7000		0.113318E 02	0.114441E 02	0.115564E 02	0.116686E 02	0.117807E 02
.8000		0.129634E 02	0.130832E 02	0.132029E 02	0.133225E 02	0.134420E 02
.9000		0.154678E 02	0.155979E 02	0.157278E 02	0.158576E 02	0.159872E 02
.9500		0.177544E 02	0.178929E 02	0.180311E 02	0.181692E 02	0.183070E 02
.9750		0.199020E 02	0.200477E 02	0.201931E 02	0.203383E 02	0.204832E 02
.9900		0.225955E 02	0.227494E 02	0.229029E 02	0.230562E 02	0.232093E 02
.9950		0.245525E 02	0.247119E 02	0.248710E 02	0.250297E 02	0.251882E 02
.9990		0.289084E 02	0.290789E 02	0.292491E 02	0.294189E 02	0.295883E 02
.9995		0.307230E 02	0.308978E 02	0.310722E 02	0.312462E 02	0.314198E 02
.9999		0.348317E 02	0.350154E 02	0.351987E 02	0.353816E 02	0.355640E 02

Print-out of FORTRAN program No. 1319

by

H. A. Richardson

This program was used to compile table 1 and part of table 2, Percentage points of the incomplete gamma-function ratio, for the following P values:

$$P = -0.95\ (0.05)4$$

$$P = 4.5\ (0.5)38$$

$$P = 39\ (1.0)50$$

```
      COMPILE   RUN  FORTRAN
C     PERCENTAGE POINTS OF THE INCOMPLETE GAMMA-FUNCTION RATIO FOR
C     THE FOLLOWING P-VALUES.
C     P = -.95(.05)4
C     P = 4.5(.5)38
C     P = 39(1.0)50
C     JOB NO. 920603-0010      PROGRAM NO. 1319
C     PROGRAMMED BY H.A.RICHARDSON      JULY 13, 1964
      DIMENSION A(429,5), B(195,12)
      REWIND 1
      REWIND 2
      REWIND 3
      READ INPUT TAPE 1, 1, ((A(I,J), J = 1, 5), I = 1, 429)
    1 FORMAT(10X,5E14.6)
      N = 0
      DO 2 I = 1, 39
      DO 2 J = 1, 11
      K = 13 - J
      M = 5*I
      L = M - 4
      N = N + 1
      IB = 1
      DO 2 IA = L, M
      B(IA,K) = A(N,IB)
    2 IB = IB + 1
      B(1,1) = - 0.95
      DO 3 I = 2, 100
    3 B(I,1) = B(I - 1,1) + 0.05
      B(101,1) = 4.5
```

```
      DO 4 I = 102, 192
    4 B(I,1) = B(I - 1,1) + 0.5
      WRITE OUTPUT TAPE 2, 5
   50FORMAT(1H1,13X,95HPERCENTAGE POINTS OF THE INCOMPLETE GAMMA-FUNCTI
     1ON RATIO FOR THE P-VALUES INDICATED IN COLUMN 1///1H0,10X,1HP,6X,
     25H1.000,4X,5H0.998,4X,5H0.990,4X,5H0.980,4X,5H0.960,4X,5H0.900,4X,
     35H0.800,4X,5H0.500,4X,5H0.200,4X,5H0.100,4X,5H0.010)
      WRITE TAPE 3, ((B(I,J), J = 1, 12), I = 1, 168)
      WRITE OUTPUT TAPE 2, 6, ((B(I,J), J = 1, 12), I = 1, 168)
    6 FORMAT(1H0/1H0,4X,12F9.3/(5X,12F9.3))
      WRITE TAPE 3, ((B(I,J), J = 1, 12), I = 170, 192, 2)
      WRITE OUTPUT TAPE 2, 7, ((B(I,J), J = 1, 12), I = 170, 192, 2)
    7 FORMAT(5X,12F9.3)
      END FILE 2
      REWIND 1
      REWIND 2
      REWIND 3
      TYPE 100
  100 FORMAT(24HEND OF JOB, UNLOAD TAPES)
      TYPE 101
  101 FORMAT(55HOUTPUT ON TAPE 11 MUST BE PRINTED UNDER FORTRAN CONTROL)
      STOP 3451
      END
```

Print-out of FORTRAN program No. 0872

by

Elgin G. Fry

This print-out is for the main program, which has been titled Hydrology study--a multipurpose program for selected cumulative probability-distribution analyses.

```
      COMPILE   RUN  FORTRAN
C      JOB NO 9206030010  PROG 0872
C      HYDROLOGY STUDY  SCS
C      JOB NUMBER 920603-0010
C      PROGRAM NUMBER 0872
C      WRITTEN BY ELGIN G. FRY  DP-SRS-USDA
C      INPUT TAPE IS 10 AND 20
C      OUTPUT TAPE IS 11, 12, AND 20
C      REELS ON 11 AND 12 ARE FILLED IN SEQUENCE
C      REEL ON 20 IS INPUT TO PROGRAM 0911
C      WORK TAPE ON 22
C
C      END OF JOB CARD--NINES PUNCHED IN COLUMNS 1-30
C
      ODIMENSION X(100,10),Y(100,10),IYR(100),XLOG(100,10),CAPX(100,10),
     1IYEAR(100,10),ISTART(10), IEND(10), DAY(10), N(10), OBS(10),
     2SUMX(10), SUMXX(10), CV(10), XM(10), GM(10), SD(10), YX(10),
     3BETA(10), BETA2(10), GAMMA(10), SQGAM(10), U(10,11), P(10),CZ(10),
     4TABLE(180,12), XLN(10), PK(11), XXN(11), CHANCE(11)
      EQUIVALENCE (X,CAPX)
      REWIND 1
      REWIND 2
      REWIND 3
      REWIND 7
      REWIND 8
      L = 2
      NUM = 0
      CHANCE(1) = 0.0
      CHANCE(2) = 0.2
```

```
CHANCE(3) = 1.0
CHANCE(4) = 2.0
CHANCE(5) = 4.0
CHANCE(6) = 10.0
CHANCE(7) = 20.0
CHANCE(8) = 50.0
CHANCE(9) = 80.0
CHANCE(10) = 90.0
CHANCE(11) = 99.0
DAY(1) = 1.0
DAY(2) = 3.0
DAY(3) = 7.0
DAY(4) = 15.0
DAY(5) = 30.0
DAY(6) = 60.0
DAY(7) = 90.0
DAY(8) = 120.0
DAY(9) = 183.0
DAY(10) = 274.0
PK(1) = ~~5.483~~ 6.015
PK(2) = 2.878
PK(3) = 2.326
PK(4) = 2.054
PK(5) = 1.751
PK(6) = 1.282
PK(7) = 0.842
PK(8) = 0.0
PK(9) = -0.842
PK(10) = -1.282
```

```
      PK(11) = -2.326
C     READ IN TABLE OF U VALUES FOR VARIOUS LEVELS OF PROBABILITY
      READ TAPE 8, ((TABLE(I,J), J=1,12), I=1,168)
      READ TAPE 8, ((TABLE(I,J), J=1,12), I=169,180)
C     READ IN PARAMETER CARD
   20 READ INPUT TAPE 1, 4, STAT1, STAT2, AREA, (ISTART(I), IEND(I),
     1I=1,10)
    4 FORMAT(2A5,F10.3,20I3)
      IF (ISTART(1)-99) 5,174,174
C     READ IN DATA CARDS
    5 K = IEND(1)
      DO 6 I=1,K
      READ INPUT TAPE 1, 8, IYR(I), (X(I,J), J=1,10)
    6 WRITE TAPE 9,          IYR(I), (X(I,J), J=1,10)
    8 FORMAT(I2,7F8.1,3F7.1)
      REWIND 9
      DO 170 KK=1,10
      DO 9 I=1,K
    9 READ TAPE 9,          IYR(I), (X(I,J), J=1,10)
      REWIND 9
      K1 = ISTART(KK)
      K2 = IEND(KK)
      K3 = K2 - 1
      IF (K1) 2,2,10
C     CHANGE STORAGE LOCATIONS
   10 DO 12 I=K1,K2
      DO 12 J=1,10
      XLOG(I,J) = 0.0
      Y(I,J) = X(I,J)
```

```
   12 IYEAR(I,J) = IYR(I)
C     PLACE Y VALUES ORDERED HIGH TO LOW
      DO 16 J=1,10
   13 DO 16 I=K1,K3
      IF (Y(I,J) - Y(I+1,J)) 14,16,16
   14 HOLD = Y(I,J)
      Y(I,J) = Y(I+1,J)
      Y(I+1,J) = HOLD
      IHOLD = IYEAR(I,J)
      IYEAR(I,J) = IYEAR(I+1,J)
      IYEAR(I+1,J) =IHOLD
      GO TO 13
   16 CONTINUE
C     CALCULATE LOG TO BASE 10 OF Y VALUES
      DO 18 I=K1,K2
      DO 18 J=1,10
      IF (Y(I,J)) 18,18,17
   17 XLOG(I,J) = LOGXF(Y(I,J))
   18 CONTINUE
C     CALCULATE CAP(X) VALUES
      IF (AREA) 19,19,22
   19 DO 20 I=K1,K2
      DO 20 J=1,10
   20 CAPX(I,J) = Y(I,J)
      GO TO 26
   22 CC = 0.03719008 / AREA
      DO 24 I=K1,K2
      DO 24 J=1,10
   24 CAPX(I,J) = Y(I,J) * DAY(J) * CC
```

```
C      WRITE HEADER LINES
   26 WRITE OUTPUT TAPE L, 28; STAT1, STAT2, AREA, KK
   280FORMAT(1H1,10X,61HHIGHEST MEAN DISCHARGE GAMMA FUNCTION PARAMETERS
     1 FOR STATION ,2A5,4X,6HAREA =,F10.3,5X,3HSET,I3)
      WRITE OUTPUT TAPE L, 30
   300FORMAT(1H0,115HYR        X(1)    LOG X(1)    CAP X(1)      YR        X(
     12)    LOG X(2)    CAP X(2)      YR        X(3)    LOG X(3)    CAP X(3) )
C      WRITE DATA VALUES
      DO 32 I=K1,K2
   320WRITE OUTPUT TAPE L, 34, IYEAR(I,1), Y(I,1), XLOG(I,1), CAPX(I,1),
     1IYEAR(I,2), Y(I,2), XLOG(I,2), CAPX(I,2), IYEAR(I,3), Y(I,3),
     2XLOG(I,3), CAPX(I,3)
   34 FORMAT(I3,F12.4,F10.6,F10.4,2(I8,F12.4,F10.6,F10.4))
      WRITE OUTPUT TAPE L, 36
   360FORMAT(1H0,115HYR        X(4)    LOG X(4)    CAP X(4)      YR        X(
     15)    LOG X(5)    CAP X(5)      YR        X(6)    LOG X(6)    CAP X(6) )
C      WRITE DATA VALUES
      DO 38 I=K1,K2
   380WRITE OUTPUT TAPE L, 34, IYEAR(I,4), Y(I,4), XLOG(I,4), CAPX(I,4),
     1IYEAR(I,5), Y(I,5), XLOG(I,5), CAPX(I,5), IYEAR(I,6), Y(I,6),
     2XLOG(I,6), CAPX(I,6)
      WRITE OUTPUT TAPE L, 40
   400FORMAT(1H0,115HYR        X(7)    LOG X(7)    CAP X(7)      YR        X(
     18)    LOG X(8)    CAP X(8)      YR        X(9)    LOG X(9)    CAP X(9) )
C      WRITE DATA VALUES
      DO 42 I=K1,K2
   420WRITE OUTPUT TAPE L, 34, IYEAR(I,7), Y(I,7), XLOG(I,7), CAPX(I,7),
     1IYEAR(I,8), Y(I,8), XLOG(I,8), CAPX(I,8), IYEAR(I,9), Y(I,9),
     2XLOG(I,9), CAPX(I,9)
```

```
      WRITE OUTPUT TAPE L, 44
   44 FORMAT(1HO,35HYR        X(10)  LOG X(10) CAP X(10)  )
      DO 46 I=K1,K2
   460WRITE OUTPUT TAPE L, 34, IYEAR(I,10), Y(I,10), XLOG(I,10), CAPX(I,
     110)
      DO 41 I=K1,K2
      DO 41 J=1,10
      IF (CAPX(I,J)) 55,55,43
   55 CAPX(I,J) = -9.0
      GO TO 41
   43 CAPX(I,J) = LOGXF(CAPX(I,J))
   41 CONTINUE
      KODE = K2 - K1 + 1
      WRITE OUTPUT TAPE 7, 45, STAT1, STAT2, AREA, KK, KODE
   45 FORMAT(2A5,F10.3,I3,I3)
      DO 49 I=K1,K2
      WRITE OUTPUT TAPE 7, 47, (CAPX(I,J), J=1,10)
   47 FORMAT(10F10.4)
   49 CONTINUE
C     CALCULATE VALUE OF N FOR EACH DAY
      DO 48 I=1,10
   48 N(I) = 0
      DO 52 I=K1,K2
      DO 52 J=1,10
      IF (Y(I,J)) 52,52, 50
   50 N(J) = N(J) + 1
   52 CONTINUE
      WRITE OUTPUT TAPE L, 53, AREA
   530FORMAT(1H1,30X,66HVOLUME-DURATION-PROBABILITY ANALYSIS FOR SELECTE
```

```
     1D WATERSHEDS        /1HO,14HNAME OF STREAM,44X,13HGAGE LOCATION/
     21HO,8HUSGS NO.,15X,7HCTU NO.,11X,16HPERIOD OF RECORD,32X,
     315HDRAINAGE AREA =,F8.3,6H SQ MI /1HO,20HDURATION IN DAYS   1,10X,
     41H3,10X,1H7,9X,2H15,9X,2H30,9X,2H60,9X,2H90,8X,3H120,8X,3H183,8X,
     53H274 )
      DO 54 I=1,10
   54 OBS(I) = N(I)
      WRITE OUTPUT TAPE L, 56, (N(I), I=1,10)
   56 FORMAT(10HON         ,10I11)
C     CALCULATE MEAN, CV
      DO 58 I=1,10
      XM(I) = 0.0
      CV(I) = 0.0
      CZ(I) = 0.0
      SD(I) = 0.0
      XLN(I) = 0.0
      GM(I) = 0.0
      SUMX(I) = 0.0
   58 SUMXX(I) = 0.0
      DO 60 I=K1,K2
      DO 60 J=1,10
      SUMX(J) = SUMX(J) + Y(I,J)
   60 SUMXX(J) = SUMXX(J) + Y(I,J) * Y(I,J)
      DO 62 J=1,10
      IF (OBS(J)) 62,62,61
   61 XM(J) = SUMX(J) / OBS(J)
     OCV(J) = ((OBS(J) * OBS(J) * SUMXX(J) - OBS(J) * SUMX(J) * SUMX(J))
     1/ ((OBS(J) - 1.0) * SUMX(J) * SUMX(J))) ** 0.5
   62 CONTINUE
```

```
C      WRITE MEANS, CV, AND SD
       WRITE OUTPUT TAPE L, 64, (CV(I), I=1,10)
   64 FORMAT(10H CV        ,10F11.5)
       WRITE OUTPUT TAPE L, 66, (XM(I), I=1,10)
   66 FORMAT(10H X BAR     ,10F11.4)
C      CONVERT LOG AREA TO LOG OF X TO BASE E
       DO 70 I=K1,K2
       DO 70 J=1,10
       IF (Y(I,J)) 70,70,69
   69 XLOG(I,J) = LOGF(Y(I,J))
   70 CONTINUE
C      CALCULATE GEOMETRIC MEAN AND C(Z)
       DO 72 I=1,10
       SUMXX(I) = 0.0
   72 SUMX(I) = 0.0
       DO 74 I=K1,K2
       DO 74 J=1,10
       SUMXX(J) = SUMXX(J) + XLOG(I,J) * XLOG(I,J)
   74 SUMX(J) = SUMX(J) + XLOG(I,J)
       DO 76 J=1,10
       IF (OBS(J)) 76,76,75
  750CZ(J) = ((OBS(J) * OBS(J) * SUMXX(J) -OBS(J) * SUMX(J) *SUMX(J))
     1/ ((OBS(J) - 1.0) * SUMX(J) * SUMX(J))) ** 0.5
       SD(J) = SUMX(J) / OBS(J)
       XLN(J) = SD(J)
       CZ(J) = CZ(J) * ABSF(XLN(J))
       GM(J) = EXPF(SD(J))
   76 CONTINUE
C      WRITE LOG GM AND THE GM
```

```
      WRITE OUTPUT TAPE L, 78, (SD(I), I=1,10)
   78 FORMAT(10H LN G      ,10F11.6)
      WRITE OUTPUT TAPE L, 80, (GM(I), I=1,10)
   80 FORMAT(10H G         ,10F11.4)
C     CALCULATE AND WRITE RATIO OF X BAR / G
      DO 82 I=1,10
      SD(I) = 0.0
      IF (OBS(I)) 82,82,81
   81 SD(I) = XM(I) / GM(I)
   82 CONTINUE
      WRITE OUTPUT TAPE L, 84, (SD(I), I=1,10)
   84 FORMAT(10H RATIO X/G,10F11.5)
C     CALCULATE AND WRITE CV* AND Y
      DO 86 I=1,10
      YX(I) = 0.0
      SUMX(I) = 0.0
      IF (OBS(I)) 86,86,85
   85 SUMX(I) = (SD(I) * SD(I) - 1.0) ** 0.5
      YX(I) = LOGF(SD(I))
   86 CONTINUE
      WRITE OUTPUT TAPE L, 88, (SUMX(I), I=1,10)
   88 FORMAT(10H CV*       ,10F11.5)
      WRITE OUTPUT TAPE L, 90, (YX(I), I=1,10)
   90 FORMAT(10H Y         ,10F11.6)
C     CALCULATE LN S.D. AND LN S.D.* (USE BETA AREA)
      DO 240 I=1,10
      BETA(I) = 0.0
      IF (OBS(I)) 240,240,241
  241 BETA(I) = (YX(I) * 2.0) ** 0.5
```

```
  240 CONTINUE
      WRITE OUTPUT TAPE L, 242, (BETA(I),I=1,10)
  242 FORMAT(10H LN S.D.  ,10F11.6)
      DO 244 I=1,10
      IF (OBS(I)) 244,244,243
  243 BETA(I) = BETA(I) * (OBS(I) / (OBS(I) - 1.0)) ** 0.5
  244 CONTINUE
      WRITE OUTPUT TAPE L, 246, (BETA(I), I=1,10)
  246 FORMAT(10H LN S.D.* ,10F11.6)
      WRITE OUTPUT TAPE L, 245, (CZ(I), I=1,10)
  245 FORMAT(10H LN S.D.**,10F11.6)
C     CALCULATE BETA AND GAMMA AND SQR ROOT OF GAMMA
      DO 99 I=1,10
      IF (OBS(I)) 247,247,248
  247 GAMMA(I) = 0.0
      BETA(I) = 0.0
      SQGAM(I) = 0.0
      GO TO 99
  248 IF (YX(I)-0.5772). 92,94,94
  920GAMMA(I) = (1.0 / YX(I)) * (0.5000876 + 0.1648852 * YX(I)
     1- 0.0544274 * YX(I) * YX(I))
      GO TO 98
   94 IF (YX(I) - 17.0) 96,96,170
  960GAMMA(I) = (8.898919 + 9.059950 * YX(I) + 0.9775373 * YX(I) *
     1YX(I)) / (YX(I) * (17.79728 + 11.968477 * YX(I) + YX(I) * YX(I)))
   98 BETA(I) = XM(I) / GAMMA(I)
      SQGAM(I) = GAMMA(I) ** 0.5
   99 CONTINUE
      GO TO 104
```

```
C      WRITE GAMMA, SQR ROOT OF GAMMA AND BETA
  104 WRITE OUTPUT TAPE L, 106, (GAMMA(I), I=1,10)
  106 FORMAT(10H GAMMA     ,10F11.5)
      WRITE OUTPUT TAPE L, 108, (SQGAM(I), I=1,10)
  108 FORMAT(10H SQR GAMMA,10F11.5)
      WRITE OUTPUT TAPE L, 110, (BETA(I), I=1,10)
  110 FORMAT(10H BETA      ,10F11.5)
C      CALCULATE AND WRITE BETA STAR (PRIME)
      DO 116 I=1,10
      IF (AREA) 114,114,112
  112 IF (OBS(I)) 114,114,113
  113 BETA2(I) = DAY(I) * 0.03719 * BETA(I) / AREA
      GO TO 116
  114 BETA2(I) = BETA(I)
  116 CONTINUE
      WRITE OUTPUT TAPE L, 118, (BETA2(I), I=1,10)
  118 FORMAT(10H BETA*     ,10F11.5)
C      SUMX = BETA X SQR ROOT GAMMA
C      SD = BETA* X SQR ROOT GAMMA
      DO 120 I=1,10
      SUMX(I) = BETA(I) * SQGAM(I)
  120 SD(I) = BETA2(I) * SQGAM(I)
      WRITE OUTPUT TAPE L, 122, (SUMX(I), I=1,10)
  122 FORMAT(10H B * S(GA),10F11.4)
      WRITE OUTPUT TAPE L, 124, (SD(I), I=1,10)
  124 FORMAT(10H B* (S(GA),10F11.6)
      DO 126 I=1,10
  126 P(I) = GAMMA(I) - 1.0
C      CALCULATE AND STORE U * B * S(GA)
```

```
      DO 127 I=1,10
      DO 127 J=1,11
  127 U(I,J) = 0.0
      DO 152 J=1,10
      IF (OBS(J)) 152,152,129
  129 IF (P(J)-50.0) 128,128,152
  128 DO 130 I=2,180
      IF (P(J)-TABLE(I,1)) 131,144,130
  130 CONTINUE
      GO TO 152
  131 IF ((P(J)-TABLE(I-1,1)) -(TABLE(I,1)-P(J)))  132,132,133
  132 PROB = (P(J) - TABLE(I-1,1)) / (TABLE(I,1) - TABLE(I-1,1))
      SW = 0.0
      GO TO 134
  133 PROB = (TABLE(I,1)-P(J)) / (TABLE(I,1) - TABLE(I-1,1))
      SW = 1.0
  134 DO 142 M=1,11
      IF (TABLE(I-1,M+1) - TABLE(I,M+1)) 138,136,136
  136 IF (SW) 137,135,137
  137 PROBT= TABLE(I,M+1) + ((TABLE(I-1,M+1) - TABLE(I,M+1)) * PROB)
      GO TO 140
  135 PROBT = TABLE(I-1,M+1) - ((TABLE(I-1,M+1)-TABLE(I,M+1)) * PROB)
      GO TO 140
  138 IF (SW) 139,139,141
  139 PROBT= TABLE(I-1,M+1) + ((TABLE(I,M+1) - TABLE(I-1,M+1)) * PROB)
      GO TO 140
  141 PROBT = TABLE(I,M+1) - ((TABLE(I,M+1) - TABLE(I-1,M+1)) * PROB)
  140 U(J,M) = PROBT* SD(J)
  142 CONTINUE
```

```
      GO TO 152
  144 DO 146 M=1,11
  146 U(J,M) = TABLE(I,M+1) * SD(J)
  152 CONTINUE
C     WRITE U * B * S(GA) VALUES
      WRITE OUTPUT TAPE L, 148
  148 FORMAT(1HO,14HPERCENT CHANCE,43X,9HU(B*S(GA))
      WRITE OUTPUT TAPE L, 154, (CHANCE(I), (U(J,I), J=1,10), I=1,11)
  154 FORMAT(1H ,F9.1,10F11.4)
      WRITE OUTPUT TAPE L, 161
  161OFORMAT(120HON = STATION YEARS, CV = COEFFICIENT OF VARIATION BY ME
     1THOD OF MOMENTS, X BAR = ARITHMETIC MEAN IN SECOND-FEET PER DAY, /
     2116H LN G = NATURAL LOGARITHUM OF THE GEOMETRIC MEAN(MEAN OF THE N
     3ATURAL LOGARITHMS OF THE ORIGINAL DATA), G = GEOMETRIC/ 120H MEAN
     4IN SECOND-FEET PER DAY, RATIO X/G = RATIO OF ARITHMETIC MEAN TO GE
     5OMETRIC MEAN, CV* = COEFFICIENT OF VARIATION BY /120H METHOD OF MA
     6XIMUM LIKELIHOOD, Y = NATURAL LOGARITHM OF THE RATIO OF THE ARITHM
     7ETIC MEAN TO THE GEOMETRIC MEAN, LN S.D. /114H AND LN S.D.* = STAN
     8DARD DEVIATION OF THE NATURAL LOGARITHMS FOR MAXIMUM LIKELIHOOD, B
     9IASED AND UNBIASED RESPECT-  )
      WRITE OUTPUT TAPE L, 185
  185OFORMAT(120H IVELY, GAMMA = SHAPE STATISTIC, SQR GAMMA = SQUARE ROO
     1T OF GAMMA, BETA AND BETA* = RATIO OF ARITHMETIC MEAN TO GAMMA IN/
     2116H SECOND-FEET PER DAY AND VOLUME IN INCHES RESPECTIVELY, B * S(
     3GA) AND B* (S(GA) = BETA TIMES THE SQUARE ROOT OF     /120H GAMMA
     4(STANDARD DEVIATION) IN SECOND-FEET PER DAY AND VOLUME IN INCHES R
     5ESPECTIVELY, U(B*S(GA) = VOLUME IN INCHES FOR   / 51H SELECTED DUR
     6ATIONS AND PERCENT CHANCE AS INDICATED / 1H1 )
      DO 155 I=1,10
```

```
      DO 155 J=1,11
      IF (U(I,J)) 151,151,153
  151 U(I,J) = -9.0
      GO TO 155
  153 U(I,J) = LOGXF(U(I,J))
  155 CONTINUE
      DO 166 I=1,10
      IF (OBS(I)) 156,156,157
  157 IF (GAMMA(I)-51.0) 156,156,158
  156 WRITE OUTPUT TAPE 7, 164, I, (U(I,J), J=1,11)
      GO TO 166
C     CALCULATE LOG-NORMAL SOLUTION
  158 DO 160 J=1,11
      XXN(J) = EXPF(XLN(I) + PK(J) * ABSF(CZ(I)))
      IF (AREA) 160,160,183
  183 XXN(J) = XXN(J) * DAY(I) * 0.03719 / AREA
  160 CONTINUE
      WRITE OUTPUT TAPE 6, 162, I, (XXN(J), J=1,11)
  162 FORMAT(1H0,I2,4X,11F10.6)
      DO 163 J=1,11
      IF (XXN(J)) 171,171,165
  171 XXN(J) = -9.0
      GO TO 163
  165 XXN(J) = LOGXF(XXN(J))
  163 CONTINUE
      WRITE OUTPUT TAPE 7, 164, I, (XXN(J), J=1,11)
  164 FORMAT(I3,4X,11F10.4)
  166 CONTINUE
  170 NUM = NUM + (4 * K2 + 37)
```

```
      IF (NUM-20000) 2,172,172
  172 END FILE L
      REWIND L
      L = L + 1
      NUM = 0
      GO TO 2
  174 END FILE L
      REWIND 1
      REWIND L
      KODE = 999
      WRITE OUTPUT TAPE 7, 45, STAT1, STAT2, AREA, KK, KODE
      END FILE 7
      REWIND 7
      REWIND 8
      TYPE 176
  176 FORMAT(10HEND OF JOB)
      STOP 9999
      END
```

Print-outs of FORTRAN programs No. 0910 and No. 0911

by

Elgin G. Fry

In order to plot on the automatic data plotter the computed output from program No. 0872 must be coded and normal order statistics for data-plotter prepared (program No. 0911).

Program No. 0910, Conversion of normal order statistics, was used in plotting the coded data. See the coded print-outs for Catawba Creek and Smiths Fork forecast, pages 91-93 and 98-101.

```
      COMPILE   RUN  FORTRAN
C      CONVERSION OF NORMAL ORDER STATISTICS
C      JOB NUMBER 920603-0010
C      PROGRAM NUMBER 0910
C      WRITTEN BY ELGIN G. FRY   DP, SRS, USDA
C
       DIMENSION X(50,100), A(100)
       REWIND 1
       REWIND 7
       READ INPUT TAPE 1, 2, ((X(I,J), J=2,8), I=1,4)
     2 FORMAT(12X,7F9.5)
       READ INPUT TAPE 1, 2, ((X(I,J), J=9,15), I=1,8)
       READ INPUT TAPE 1, 2, ((X(I,J), J=16,22), I=1,11)
       READ INPUT TAPE 1, 2, ((X(I,J), J=23,29), I=1,15)
       READ INPUT TAPE 1, 2, ((X(I,J), J=30,36), I=1,18)
       READ INPUT TAPE 1, 2, ((X(I,J), J=37,43), I=1,22)
       READ INPUT TAPE 1, 2, ((X(I,J), J=44,50), I=1,25)
       READ INPUT TAPE 1, 2, ((X(I,J), J=51,57), I=1,29)
       READ INPUT TAPE 1, 2, ((X(I,J), J=58,64), I=1,32)
       READ INPUT TAPE 1, 2, ((X(I,J), J=65,71), I=1,36)
       READ INPUT TAPE 1, 2, ((X(I,J), J=72,78), I=1,39)
       READ INPUT TAPE 1, 2, ((X(I,J), J=79,85), I=1,43)
       READ INPUT TAPE 1, 2, ((X(I,J), J=86,92), I=1,46)
       READ INPUT TAPE 1, 2, ((X(I,J), J=93,99), I=1,50)
       READ INPUT TAPE 1, 4, (X(I,100), I=1,50)
     4 FORMAT(12X,F9.5)
       DO 14 I=2,100
       DO 6 J=1,I
     6 A(J) = 0.0
       K = I
       M = I / 2
       DO 8 J=1,M
       A(J) = X(J,I)
       A(K) = -X(J,I)
       K = K - 1
     8 CONTINUE
       DO 10 J=1,I
    10 A(J) = A(J) + 4.0
       WRITE OUTPUT TAPE 7, 12, (A(J), J=1,I)
    12 FORMAT(10F10.5)
    14 CONTINUE
       END FILE 7
       REWIND 1
       REWIND 7
       TYPE 16
    16 FORMAT(10HEND OF JOB)
       STOP 9999
       END
```

```
  COMPILE   RUN  FORTRAN
   PREPARATION OF NORMAL ORDER STATISTICS FOR DATAPLOTTER
   JOB NUMBER 920603-0010
   PROGRAM NUMBER 0911
   WRITTEN BY ELGIN G. FRY   DP, SRS, USDA
   DIMENSION X(5050), A(100), P(11), CAP(100,10), SOL(10,11), N(10)
   REWIND 1
   REWIND 2
   REWIND 3
   REWIND 7
   REWIND 8
   LINE = 0
   L = 1
   DO 6 I=2,100
   READ INPUT TAPE 7, 2, (A(J), J=1,I)
 2 FORMAT(10F10.5)
   K = I * (I - 1) / 2 + 1
   NN = I * (I + 1) / 2
   J = 0
   DO 4 M=K,NN
   J = J + 1
 4 X(M) = A(J)
 6 CONTINUE
   DO 8 I=2,5050
 8 X(I) = X(I) * 0.1
   P(1) = 0.9040 — 0.9483 (Future .9999)
                   Now
   P(2) = 0.6878
   P(3) = 0.6326
   P(4) = 0.6054
   P(5) = 0.5751
   P(6) = 0.5282
   P(7) = 0.4842
   P(8) = 0.4000
   P(9) = 0.3158
   P(10) = 0.2355 0.2718
   P(11) = 0.1674
10 READ INPUT TAPE 8, 12, STAT1, STAT2, AREA, KK, KODE
12 FORMAT(2A5,F10.3,I3,I3)
   IF (KODE-999) 14,50,50
14 DO 18 I=1,KODE
   READ INPUT TAPE 8, 16, (CAP(I,J), J=1,10)
16 FORMAT(10F10.4)
```

```
18 CONTINUE
   READ INPUT TAPE 8, 20, ((SOL(I,J), J=1,11), I=1,10)
20 FORMAT(7X,11F10.4)
   DO 22 I=1,10
22 N(I) = 0
   DO 26 I=1,KODE
   DO 26 J=1,10
   IF (CAP(I,J)+9.0) 24,26,24
24 N(J) = N(J) + 1
26 CONTINUE
   DO 27 I=1,KODE
   DO 27 J=1,10
27 CAP(I,J) = (CAP(I,J) + 4.0) * 0.1
   DO 28 I=1,10
   DO 28 J=1,11
28 SOL(I,J) = (SOL(I,J) + 4.0) * 0.1
   DO 44 I=1,10
   IF (N(I)) 44,44,30
30 K = N(I) * (N(I) - 1) / 2 + 1
   NN = N(I) * (N(I) + 1) / 2
   J = 1
   WRITE OUTPUT TAPE L, 32, STAT1, STAT2, KK, I, X(K), CAP(J,I), J
32 FORMAT(2A5,2I3,2F8.4,19X,1H9,I8)
   K = K + 1
   DO 36 M=K,NN
   J = J + 1
   WRITE OUTPUT TAPE L, 34, STAT1, STAT2, KK, I, X(M), CAP(J,I), J
34 FORMAT(2A5,2I3,2F8.4,19X,1H8,I8)
36 CONTINUE
   J = J + 1
   WRITE OUTPUT TAPE L, 38, STAT1, STAT2, KK, I, X(NN), CAP(J-1,I), J
38 FORMAT(2A5,2I3,2F8.4,19X,1H7,I8)
   DO 39 JJ=1,11
   IF (SOL(I,JJ)) 39,39,41
41 J = J + 1
   II = JJ
   WRITE OUTPUT TAPE L, 40, STAT1, STAT2, KK, I, P(JJ), SOL(I,JJ), J
40 FORMAT(2A5,2I3,2F8.4,20X,I8)
39 CONTINUE
   J = J + 1
   WRITE OUTPUT TAPE L, 38, STAT1, STAT2, KK, I, P(II), SOL(I,II), J
   LINE = LINE + N(I) + 20
```

```
      IF (LINE-25000) 44,42,42
42    END FILE L
      REWIND L
      L = L + 1
      LINE = 0
44    CONTINUE
      GO TO 10
50    REWIND 7
      REWIND 8
      END FILE L
      REWIND L
      TYPE 52
52    FORMAT(10HEND OF JOB)
      STOP 9999
      END
```

Preparation of data furnished by U.S. Geological Survey (USGS)

USGS provides the annual (water year) high-flow volumes for periods of 1, 3, 7, 15, 30, 60, 90, 120, 150, 183, and 274 days for stream-gage records requested by the Central Technical Unit, SCS.

The data received from USGS are on tape or ozalid prints. If ozalid prints are received, the IBM cards are key-punched and verified before processing. For tape, the following programs, Compile run autocoder by P. Antoinette Vann and format USGS data, FORTRAN program No. 1183, are used to punch cards directly from USGS tape. The header cards are inserted before listing for visual inspection and analysis on the computer. Catawba Creek near Catawba, Va., Station No. 02-0185.00, drainage area = 34.0 sq. mi., for 1944-62, is a typical example.

```
0101 COMPILE   RUN  AUTOCODER                                          1141
0102 *  JOB NO.  920603-0010                                           1141
0103 *             PROGRAMMER   P.ANTOINETTE VANN                      1141
0104 *                                                                 1141
0105 ORIGIN    CNTRL0350                                               1141
0105 INPUT     DA   2,RDW,0+X13                                        1141
0106 STATNO         00,21-A                                            1141
0107 WATERYR        44,65-A                                            1141
0108 HIDAY          66,87-A                                            1141
0109 HIDAY3         88,109-A                                           1141
0110 HIDAY7         110,131-A                                          1141
0111 HIDAY15        132,153-A                                          1141
0112 HIDAY30        154,175-A                                          1141
0113 HIDAY60        176,197-A                                          1141
0114 HIDAY90        198,219-A                                          1141
0115 HIDAY120       220,241-A                                          1141
0116 HIDAY183       264,285-A                                          1141
0117 HIDAY274       286,307-A                                          1141
0118                309                                                1141
0119 WORKA     DA   1,RDW                                             1141
0120 ASTATNO        00,19-A                                            1141
0121                159                                                1141
0201 WORKB     DA   1,RDW                                             1141
0202 BWATERYR       00,03-A                                            1141
0203 BHIDAY         04,19-A                                            1141
0204 BHIDAY3        20,35-A                                            1141
0205 BHIDAY7        36,51-A                                            1141
0206 BHIDAY15       52,67-A                                            1141
0207 BHIDAY30       68,83-A                                            1141
0208 BHIDAY60       84,99-A                                            1141
0209 BHIDAY90       100,115-A                                          1141
0210 BHIDAY120      116,129-A                                          1141
0211 BHIDAY183      130,143-A                                          1141
0212 BHIDAY274      144,157-A                                          1141
0213                159                                                1141
0214 OUTPUT    DA   2,RDW,0+X15                                        1141
0215                159                                                1141
0216           DC                                                      1141
0217 HOLD           -           -                                      1141
0218 NINES          -999999999-                                        1141
0301 START     ESF  1                                                  1141
0302           SMSC                                                    1141
```

```
0303              SMFV                                          1141
0304              OPEN  1NPUT,OUTPUT                            1141
0305 READ         GET   1NPUT                                   1141
0306              BSN   1,CKSTAT                                1141
0307 NEWNO        ZA1   STATNO(2,9)                             1141
03072             ZA2   STATNO(10,19)                          1141
03073             SL    2                                       1141
03074             A2    STATNO(20,21)                           1141
03075             ST2   HOLD(10,19)                             1141
03076             ST1   HOLD(0,9)                               1141
03077             ST2   ASTATNO(10,19)                         1141
03078             ST1   ASTATNO(0,9)                           1141
0309              PUT   WORKA 1N OUTPUT                         1141
0310              B     DETA1LS                                 1141
0311 CKSTAT       ZA1   STATNO(2,9)                             1141
03112             ZA2   STATNO(10,19)                          1141
03113             SL    2                                       1141
03114             A2    STATNO(20,21)                           1141
03115             CA    HOLD(0,9)                               1141
03116             BE    LASTCK                                  1141
03117             B     NEWNO                                   1141
03118LASTCK       C2    HOLD(10,19)                             1141
03119             BE    DETAILS                                 1141
0312              B     NEWNO                                   1141
03121DETAILS      ZA2   WATERYR(18,19)                         1141
0313              SL2   2                                       1141
0314              A2    WATERYR(20,21)                          1141
0315              ST2   BWATERYR                                1141
0316              ZA1   HIDAY(6,9)                              1141
0317              SL1   2                                       1141
0318              A1    H1DAY(10,11)                            1141
0319              ZA2   HIDAY(12,13)                           1141
0320              SL2   8                                       1141
0321              A2    H1DAY(14,21)                            1141
0322              ST2   BHIDAY(6,15)                           1141
0323              ST1   BH1DAY(0,5)                            1141
0401              ZA1   H1DAY3(6,9)                            1141
0402              SL1   2                                       1141
0403              A1    HIDAY3(10,11)                           1141
0404              ZA2   H1DAY3(12,19)                          1141
0405              SL2   2                                       1141
0406              A2    H1DAY3(20,21)                           1141
```

```
0407            ST2   BHIDAY3(10,15)                                    1141
0408            SR2   6                                                 1141
0409            ST2   BHIDAY3(6,9)                                      1141
0410            ST1   BHIDAY3(0,5)                                      1141
0411            ZA1   HIDAY7(6,9)                                       1141
0412            SL1   2                                                 1141
0413            A1    HIDAY7(10,11)                                     1141
0414            ZA2   HIDAY7(12,19)                                     1141
0415            SL2   2                                                 1141
0416            A2    HIDAY7(20,21)                                     1141
0417            ST2   BHIDAY7(14,15)                                    1141
0418            SR2   2                                                 1141
0419            ST2   BHIDAY7(06,13)                                    1141
0420            ST1   BHIDAY7(04,05)                                    1141
0421            SR1   2                                                 1141
0422            ST1   BHIDAY7(0,3)                                     1141
0423 *                                                                  1141
0424 *  MOVING DAYS 15--90, LAST OF THE EIGHT DIGIT DAYS                1141
0425 *                                                                  1141
0501            ZA1   HIDAY15(6,7)                                      1141
0502            SL1   4                                                 1141
0503            A1    HIDAY15(8,11)                                     1141
0504            ZA2   HIDAY15(12,17)                                    1141
0505            SL2   4                                                 1141
0506            A2    HIDAY15(18,21)                                    1141
0507            ST2   BHIDAY15(8,15)                                    1141
0508            SR2   8                                                 1141
0509            ST2   BHIDAY15(6,7)                                     1141
0510            ST1   BHIDAY15(0,5)                                     1141
0511 *                                                                  1141
0512            ZA1   HIDAY30(6,15)                                     1141
0513            ZA2   HIDAY30(16,21)                                    1141
0514            ST2   BHIDAY30(12,15)                                   1141
0515            SR2   4                                                 1141
0516            ST2   BHIDAY30(10,11)                                   1141
0517            ST1   BHIDAY30(2,9)                                     1141
0518            SR1   8                                                 1141
0519            ST1   BHIDAY30(0,1)                                     1141
0520 *                                                                  1141
0521            ZA1   HIDAY60(6,13)                                     1141
0522            SL1   2                                                 1141
0523            A1    HIDAY60(14,15)                                    1141
```

```
0524              ZA2   HIDAY60(16,21)                                1141
0601              ST2   BHIDAY60(10,15)                               1141
0602              ST1   BHIDAY60(6,9)                                 1141
0603              SR1   4                                             1141
0604              ST1   BHIDAY60(0,5)                                 1141
0605 *                                                                1141
0606              ZA1   HIDAY90(6,11)                                 1141
0607              ZA2   HIDAY90(12,21)                                1141
0608              ST2   BHIDAY90(10,15)                               1141
0609              SR2   6                                             1141
0610              ST2   BHIDAY90(6,9)                                 1141
0611              ST1   BHIDAY90(0,5)                                 1141
0612 *                                                                1141
0613 *  CONVERTING TO SEVEN DIGIT FIELDS                              1141
0614 *                                                                1141
0615              ZA1   HIDAY120(8,9)                                 1141
0616              SL1   2                                             1141
0617              A1    HIDAY120(10,11)                               1141
0618              ZA2   HIDAY120(12,19)                               1141
0619              SL2   2                                             1141
0620              A2    HIDAY120(20,21)                               1141
0621              ST2   BHIDAY120(4,13)                               1141
0622              ST1   BHIDAY120(0,3)                                1141
0701              ZA1   HIDAY183(8,15)                                1141
0702              ZA2   HIDAY183(16,21)                               1141
0703              ST2   BHIDAY183(10,13)                              1141
0704              SR2   4                                             1141
0705              ST2   BHIDAY183(8,9)                                1141
0706              ST1   BHIDAY183(0,7)                                1141
0707              ZA1   HIDAY274(8,13)                                1141
0708              ZA2   HIDAY274(14,21)                               1141
0709              ST2   BHIDAY274(6,13)                               1141
0710              ST1   BHIDAY274(0,5)                                1141
0711              PUT   WORKB IN OUTPUT                               1141
0712              B     READ                                          1141
0713 *                                                                1141
0714 *  END-OF-FILE ROUTINE FOR INPUT                                 1141
0715 *                                                                1141
0716 FINISH       MOVE NINES TO ASTATNO                               1141
0717              PUT   WORKA IN OUTPUT                               1141
0718              CLOSEINPUT,OUTPUT                                   1141
0719 ATLAST       END                                                 1141
```

```
0722 ORIGIN     CNTRL0325                                          1141
0801 TAPEFILE11DTF   INPUT                                         1141
0802 FCHANNEL11      1                                             1141
0803 BASETAPE11      1                                             1141
0804 ALT1TAPE11                                                    1141
0805 ALT2TAPE11                                                    1141
0806 ACTIVITY11                                                    1141
0807 BLOCKCNT11                                                    1141
0808 FILEFORM11      1                                             1141
0809 FILETYPE11      1                                             1141
0810 RECLNGTH11      0031                                          1141
0811 BLOCKING11      0001                                          1141
0812 OPENPROC11      2                                             1141
0813 CLSEPROC11      3                                             1141
0814 TPERROPT11      50                                            1141
0815 IORDWLST11      INPUT                                         1141
0816 IOMETHOD11                                                    1141
0817 TIOAREAS11      2                                             1141
0818 PRIORITY11                                                    1141
0819 INDXWRDA11      13                                            1141
0820 INDXWRDB11      14                                            1141
0821 TDENSITY11      2                                             1141
0822 SLRPROCD11                                                    1141
0823 LLRPROCD11                                                    1141
0824 SCLPROCD11                                                    1141
0825 TPERRFLD11                                                    1141
0826 TPSKPFLD11                                                    1141
0827 EOSPROCD11      9999                                          1141
0828 EORPROCD11                                                    1141
0829 EOFPROCD11      FINISH                                        1141
0830 RWDPROCD11      3                                             1141
0831 CHECKPNT11                                                    1141
0832 LABELINF11                                                    1141
0833 SRBFORM411                                                    1141
0834 RLIFORM311                                                    1141
0835 SPAREINF11                                                    1141
0836 SCHEDINF11                                                    1141
0901 TAPEFILE21DTF   OUTPUT                                        1141
0902 FCHANNEL21      2                                             1141
0903 BASETAPE21      1                                             1141
0904 ALT1TAPE21                                                    1141
0905 ALT2TAPE21                                                    1141
```

```
0906 ACTIV1TY21                                                    1141
0907 BLOCKCNT21                                                    1141
0908 F1LEFORM21      1                                             1141
0909 F1LETYPE21      3                                             1141
0910 RECLNGTH21      0016                                          1141
0911 BLOCKING21      0001                                          1141
0912 OPENPROC21      2                                             1141
0913 CLSEPROC21      3                                             1141
0914 TPERROPT21      50                                            1141
0915 1ORDWLST21      OUTPUT                                        1141
0916 IOMETHOD21                                                    1141
0917 T1OAREAS21      2                                             1141
0918 PRIORITY21                                                    1141
0919 1NDXWRDA21      15                                            1141
0920 INDXWRDB21      16                                            1141
0921 TDENSITY21                                                    1141
0922 SLRPROCD21                                                    1141
0923 LLRPROCD21                                                    1141
0924 SCLPROCD21                                                    1141
0925 TPERRFLD21                                                    1141
0926 TPSKPFLD21                                                    1141
0927 EOSPROCD21      9999                                          1141
0928 EORPROCD21                                                    1141
0929 EOFPROCD21                                                    1141
0930 RWDPROCD21      3                                             1141
0931 CHECKPNT21                                                    1141
0932 LABELINF21                                                    1141
0933 SRBFORM421                                                    1141
0934 RL1FORM321                                                    1141
0935 SPAREINF21                                                    1141
0936 SCHED1NF21                                                    1141
0937 OR1GIN    CNTRLATLAST+2                                       1141
99050101C•1OPEN EQU  9210
99060101C•IRTAINEQU  9443
99070101C•RDLABLEQU  9159
99080101C•WRLABLEQU  9161
99090101CS1XF   EQU  10
99100101CS1XG   EQU  11
99110101C•LBAREAEQU  9142
99120101C•RLSMODEQU  9984
99130101C•HLD97 EQU  9983
99140101C•TEF   EQU  8824
```

```
9915∪IOC.FEOILBEQU  8854
9916∪IOC.OPNSW2EQU  9040
9917∪IOC.RETRN EQU  9551
9918∪IOC.IGEN  EQU  8702
9919∪IOC.ICHECKEQU  9479
9920∪IOC.CELOOPEQU  9913
9921∪IOC.EOR   EQU  8789
9922∪IOC.RETEOREQU  9536
9923∪IOC.CNBTSTEQU  8783
9924∪IOC.CEBACKEQU  9930
9925∪IOC.IPSLO EQU  9461
9926∪IOC.ICLOSEEQU  9899
9927∪IOC.IEND  EQU  9892
99999END       CNTRLSTART                                    1141
```

```
PARAMI9Z1010P
C       FORMATS DATA FROM GS
C       JOB NUMBER 920603-0030
C       PROGRAM NUMBER 1183
        DIMENSION X(10)
     1  READ INPUT TAPE 1, 6, K, J, N
     6  FORMAT(I2,I8,1X,I8)
        IF (K-99) 32,30,30
    30  IF (J-99999999) 42,20,20
    32  IF (K-1) 34,42,42
    34  IF (N-1) 36,42,42
    36  PRINT 38, K, J
    38  FORMAT(1H1,I2,I8)
        PUNCH 40, K, J
    40  FORMAT(I2,I8)
        GO TO 1
    42  BACKSPACE 1
     2  READ INPUT TAPE 1, 4, K, (X(I), I=1,10)
     4  FORMAT(I2,7F8.2,3F7.2)
        PRINT 16, K, (X(I), I=1,10)
    16  FORMAT(1H0,I2,7F8.1,3F7.1)
        PUNCH 54,K, (X(I), I=1,10)
    54  FORMAT(I2,7F8.1,3F7.1)
        GO TO 1
    20  REWIND 1
        PRINT 22
    22  FORMAT(1H1,25X,10HEND OF RUN ////)
        STOP 999
        END

                    0000
```

UNITED STATES DEPARTMENT OF THE INTERIOR

Geological Survey - Water Resources Division

Catawba Creek near Catawba, Va. Station Number 02-0185.00 Drainage Area = 34.0 Sq. Mi.

Highest Mean Discharge for following Number of Consecutive Days in Year Ending September 30

YR.	1	3	7	15	30	60	90	120 *	183	274
44	360.0	197.0	121.0	109.0	96.5	80.1	63.4	50.8	38.6	27.8
45	670.0	415.0	214.0	117.0	85.1	57.1	53.0	46.4	37.3	32.9
46	305.0	228.0	172.0	127.0	86.6	80.2	71.6	66.2	58.4	44.4
47	585.0	308.0	242.0	148.0	107.0	65.4	65.7	62.8	48.1	39.0
48	1080.0	521.0	305.0	175.0	169.0	116.0	94.3	80.2	76.0	65.5
49	1540.0	814.0	402.0	216.0	180.0	123.0	108.0	103.0	95.3	90.8
50	622.0	348.0	207.0	147.0	117.0	83.1	67.3	62.9	52.7	43.2
51	765.0	392.0	342.0	256.0	210.0	131.0	106.0	87.0	70.6	56.7
52	462.0	319.0	189.0	166.0	114.0	93.3	78.4	78.5	61.8	49.9
53	1010.0	466.0	261.0	174.0	133.0	109.0	90.0	80.3	66.7	48.5
54	1390.0	547.0	271.0	153.0	92.9	59.4	47.0	40.3	30.5	22.7
55	538.0	346.0	264.0	183.0	164.0	114.0	93.5	78.7	61.8	46.5
56	290.0	164.0	101.0	70.5	46.3	37.6	35.8	29.5	21.3	16.0
57	620.0	339.0	241.0	199.0	155.0	113.0	105.0	86.8	68.6	52.7
58	858.0	655.0	383.0	233.0	161.0	145.0	119.0	104.0	82.9	62.0
59	968.0	326.0	141.0	104.0	68.6	49.1	38.3	33.4	26.7	22.0
60	796.0	493.0	323.0	244.0	154.0	128.0	102.0	88.3	71.1	57.2
61	375.0	215.0	149.0	102.0	93.5	76.9	67.7	56.9	40.9	30.9
62	639.0	319.0	198.0	160.0	132.0	109.0	87.7	87.7	71.7	54.4

* 150-day data deleted

SOIL CONSERVATION SERVICE

Water Supply Forecasting Branch

Smiths Fork Forecast Station Number SM-FK-FC Drainage Area = 0.00

YR.	1	2	3	4	5	6	7	8	9	10
48	21.7	111.0	2.0	19.7	0.6	20.3	43.6	128.0	1250.0	18.1
49	22.0	102.0	3.1	18.9	1.1	20.0	43.5	180.0	1202.0	16.9
50	29.0	153.0	0.3	28.7	0.8	29.5	44.4	207.0	1238.0	24.5
51	31.3	149.0	1.7	29.6	0.6	30.2	45.9	238.0	1140.0	23.9
52	27.2	126.0	2.4	24.8	0.6	25.4	45.8	191.0	1222.0	19.9
53	21.2	99.0	4.9	16.3	1.1	17.4	40.0	213.0	1253.0	15.8
54	26.4	89.0	3.8	22.6	0.7	23.3	45.9	280.0	1335.0	14.4
55	19.6	78.0	3.7	15.9	0.6	16.5	41.3	217.0	1427.0	12.4
56	34.8	152.0	2.3	32.5	0.9	33.4	49.7	179.0	1382.0	23.8
57	26.6	148.0	4.0	22.6	2.1	24.7	39.0	193.0	1314.0	24.1
58	25.6	112.0	3.6	22.0	0.8	22.8	43.2	182.0	1318.0	18.8
59	22.6	80.0	3.9	18.7	1.1	19.8	45.3	241.0	1263.0	13.1
60	20.0	83.0	2.0	18.0	1.0	19.0	41.9	251.0	1329.0	14.3
61	16.8	49.0	2.0	14.8	0.7	15.5	44.9	190.0	1446.0	9.0
62	31.7	142.0	2.2	29.5	1.2	30.7	45.0	255.0	1413.0	22.7
63	22.0	95.0	3.7	18.3	0.7	19.0	40.3	226.0	1438.0	15.4

Automatic data plotting

The following print-out of coded raw and computed data for Catawba Creek and Smiths Fork is from tape. The automatic data plotter[2] plots from cards punched from this tape and a range card made up manually.

1. Column 1 is the station number (can be any 10 digits or symbols).

2. Column 2 is the set number (can be 10 sets, only one in this print-out).

3. Column 3 is the curve number or field designation, which goes from 1 to 10 if all fields are used. Both of our examples contain 10 columns of data.

4. Column 4 is the coded plotting position, which is a function of the sample size except as noted in item 6.

5. Column 5 gives the coded raw and computed data. See item 6.

6. Column 6 is a code used for line or dot mode plotting--9 is the code on card 1, 8 on cards 2 through 19 (sample size is 19 years), and 7 a stop code on card 20. Cards 21 through 31 are for the 11 computed points with their respective coded plotting positions given in column 4 (0.9483 is the 0.0 probability level and 0.1674 is the 99.0 percent level).

7. The last column gives the card numbers for each column or field. The total is the sample size plus 13 (11 probabilities and 2 stop cards coded 7). Catawba Creek, N = 19 (years of record) plus 13, has a total of 32 cards for each of the 10 curves. Smiths Fork, N = 16 (years of record) plus 13, has a total of 29 cards for all curves except curve 3 for which N = 15, a total of 28 cards.

The ADP plotting on log normal probability paper for Catawba Creek follows the print-out.

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[2] Dataplotter Model 3300 manufactured by Electronics Associates, Inc., Long Branch, N. J.

02-0185.00	1	1	0.5844	0.4227			9	1	
02-0185.00	1	1	0.5380	0.4182			8	2	
02-0185.00	1	1	0.5099	0.4072			8	3	1 of 12
02-0185.00	1	1	0.4886	0.4043			8	4	
02-0185.00	1	1	0.4707	0.4025			8	5	
02-0185.00	1	1	0.4548	0.3972			8	6	
02-0185.00	1	1	0.4402	0.3940			8	7	
02-0185.00	1	1	0.4264	0.3923			8	8	
02-0185.00	1	1	0.4131	0.3865			8	9	
02-0185.00	1	1	0.4000	0.3844			8	10	
02-0185.00	1	1	0.3869	0.3833			8	11	
02-0185.00	1	1	0.3736	0.3831			8	12	
02-0185.00	1	1	0.3598	0.3806			8	13	
02-0185.00	1	1	0.3452	0.3770			8	14	
02-0185.00	1	1	0.3293	0.3704			8	15	
02-0185.00	1	1	0.3114	0.3613			8	16	
02-0185.00	1	1	0.2901	0.3595			8	17	
02-0185.00	1	1	0.2620	0.3523			8	18	
02-0185.00	1	1	0.2156	0.3501			8	19	
02-0185.00	1	1	0.2156	0.3501			7	20	
02-0185.00	1	1	0.9483	0.4720				21	
02-0185.00	1	1	0.6878	0.4350				22	
02-0185.00	1	1	0.6326	0.4272				23	
02-0185.00	1	1	0.6054	0.4231				24	
02-0185.00	1	1	0.5751	0.4185				25	
02-0185.00	1	1	0.5282	0.4108				26	
02-0185.00	1	1	0.4842	0.4032				27	
02-0185.00	1	1	0.4000	0.3872				28	
02-0185.00	1	1	0.3158	0.3690				29	
02-0185.00	1	1	0.2718	0.3584				30	
02-0185.00	1	1	0.1674	0.3300				31	
02-0185.00	1	1	0.1674	0.3300			7	32	
02-0185.00	1	2	0.5844	0.4427			9	1	
02-0185.00	1	2	0.5380	0.4332			8	2	
02-0185.00	1	2	0.5099	0.4254			8	3	
02-0185.00	1	2	0.4886	0.4233			8	4	
02-0185.00	1	2	0.4707	0.4209			8	5	
02-0185.00	1	2	0.4548	0.4185			8	6	
02-0185.00	1	2	0.4402	0.4134			8	7	
02-0185.00	1	2	0.4264	0.4109			8	8	
02-0185.00	1	2	0.4131	0.4058			8	9	
02-0185.00	1	2	0.4000	0.4055			8	10	
02-0185.00	1	2	0.3869	0.4046			8	11	
02-0185.00	1	2	0.3736	0.4029			8	12	
02-0185.00	1	2	0.3598	0.4020			8	13	
02-0185.00	1	2	0.3452	0.4020			8	14	
02-0185.00	1	2	0.3293	0.4005			8	15	
02-0185.00	1	2	0.3114	0.3874			8	16	
02-0185.00	1	2	0.2901	0.3849			8	17	
02-0185.00	1	2	0.2620	0.3811			8	18	
02-0185.00	1	2	0.2156	0.3731			8	19	
02-0185.00	1	2	0.2156	0.3731			7	20	
02-0185.00	1	2	0.9483	0.4850				21	
02-0185.00	1	2	0.6878	0.4508				22	

Note:
Range for plotting Catawba Creek
.3000 lower limit = 10^{-1} = 0.1 inches
.6000 upper limit = 10^{2} = 100 inches

02-0185.00	1	2	0.6326	0.4437		23
02-0185.00	1	2	0.6054	0.4401		24
02-0185.00	1	2	0.5751	0.4359		25
02-0185.00	1	2	0.5282	0.4291		26
02-0185.00	1	2	0.4842	0.4224		27
02-0185.00	1	2	0.4000	0.4084		28
02-0185.00	1	2	0.3158	0.3928		29
02-0185.00	1	2	0.2718	0.3839		30
02-0185.00	1	2	0.1674	0.3603		31
02-0185.00	1	2	0.1674	0.3603	7	32
02-0185.00	1	3	0.5844	0.4488	9	1
02-0185.00	1	3	0.5380	0.4467	8	2
02-0185.00	1	3	0.5099	0.4418	8	3
02-0185.00	1	3	0.4886	0.4393	8	4
02-0185.00	1	3	0.4707	0.4368	8	5
02-0185.00	1	3	0.4548	0.4317	8	6
02-0185.00	1	3	0.4402	0.4306	8	7
02-0185.00	1	3	0.4264	0.4301	8	8
02-0185.00	1	3	0.4131	0.4268	8	9
02-0185.00	1	3	0.4000	0.4266	8	10
02-0185.00	1	3	0.3869	0.4215	8	11
02-0185.00	1	3	0.3736	0.4200	8	12
02-0185.00	1	3	0.3598	0.4181	8	13
02-0185.00	1	3	0.3452	0.4161	8	14
02-0185.00	1	3	0.3293	0.4120	8	15
02-0185.00	1	3	0.3114	0.4057	8	16
02-0185.00	1	3	0.2901	0.4033	8	17
02-0185.00	1	3	0.2620	0.3967	8	18
02-0185.00	1	3	0.2156	0.3888	8	19
02-0185.00	1	3	0.2156	0.3888	7	20
02-0185.00	1	3	0.9483	0.4956		21
02-0185.00	1	3	0.6878	0.4632		22
02-0185.00	1	3	0.6326	0.4567		23
02-0185.00	1	3	0.6054	0.4533		24
02-0185.00	1	3	0.5751	0.4494		25
02-0185.00	1	3	0.5282	0.4431		26
02-0185.00	1	3	0.4842	0.4369		27
02-0185.00	1	3	0.4000	0.4242		28
02-0185.00	1	3	0.3158	0.4101		29
02-0185.00	1	3	0.2718	0.4021		30
02-0185.00	1	3	0.1674	0.3812		31
02-0185.00	1	3	0.1674	0.3812	7	32
02-0185.00	1	4	0.5844	0.4623	9	1
02-0185.00	1	4	0.5380	0.4602	8	2
02-0185.00	1	4	0.5099	0.4582	8	3
02-0185.00	1	4	0.4886	0.4550	8	4
02-0185.00	1	4	0.4707	0.4514	8	5
02-0185.00	1	4	0.4548	0.4478	8	6
02-0185.00	1	4	0.4402	0.4458	8	7
02-0185.00	1	4	0.4264	0.4456	8	8
02-0185.00	1	4	0.4131	0.4435	8	9
02-0185.00	1	4	0.4000	0.4419	8	10
02-0185.00	1	4	0.3869	0.4400	8	11
02-0185.00	1	4	0.3736	0.4385	8	12

02-0185.00	1	4	0.3598	0.4382	8	13	
02-0185.00	1	4	0.3452	0.4319	8	14	
02-0185.00	1	4	0.3293	0.4283	8	15	3 of 12
02-0185.00	1	4	0.3114	0.4253	8	16	
02-0185.00	1	4	0.2901	0.4232	8	17	
02-0185.00	1	4	0.2620	0.4224	8	18	
02-0185.00	1	4	0.2156	0.4063	8	19	
02-0185.00	1	4	0.2156	0.4063	7	20	
02-0185.00	1	4	0.9483	0.5058		21	
02-0185.00	1	4	0.6878	0.4760		22	
02-0185.00	1	4	0.6326	0.4700		23	
02-0185.00	1	4	0.6054	0.4670		24	
02-0185.00	1	4	0.5751	0.4635		25	
02-0185.00	1	4	0.5282	0.4578		26	
02-0185.00	1	4	0.4842	0.4523		27	
02-0185.00	1	4	0.4000	0.4411		28	
02-0185.00	1	4	0.3158	0.4287		29	
02-0185.00	1	4	0.2718	0.4218		30	
02-0185.00	1	4	0.1674	0.4039		31	
02-0185.00	1	4	0.1674	0.4039	7	32	
02-0185.00	1	5	0.5844	0.4838	9	1	
02-0185.00	1	5	0.5380	0.4771	8	2	
02-0185.00	1	5	0.5099	0.4744	8	3	
02-0185.00	1	5	0.4886	0.4731	8	4	
02-0185.00	1	5	0.4707	0.4723	8	5	
02-0185.00	1	5	0.4548	0.4706	8	6	
02-0185.00	1	5	0.4402	0.4704	8	7	
02-0185.00	1	5	0.4264	0.4640	8	8	
02-0185.00	1	5	0.4131	0.4637	8	9	
02-0185.00	1	5	0.4000	0.4584	8	10	
02-0185.00	1	5	0.3869	0.4573	8	11	
02-0185.00	1	5	0.3736	0.4546	8	12	
02-0185.00	1	5	0.3598	0.4501	8	13	
02-0185.00	1	5	0.3452	0.4487	8	14	
02-0185.00	1	5	0.3293	0.4484	8	15	
02-0185.00	1	5	0.3114	0.4454	8	16	
02-0185.00	1	5	0.2901	0.4446	8	17	
02-0185.00	1	5	0.2620	0.4352	8	18	
02-0185.00	1	5	0.2156	0.4182	8	19	
02-0185.00	1	5	0.2156	0.4182	7	20	
02-0185.00	1	5	0.9483	0.5290		21	
02-0185.00	1	5	0.6878	0.4973		22	
02-0185.00	1	5	0.6326	0.4909		23	
02-0185.00	1	5	0.6054	0.4876		24	
02-0185.00	1	5	0.5751	0.4838		25	
02-0185.00	1	5	0.5282	0.4777		26	
02-0185.00	1	5	0.4842	0.4717		27	
02-0185.00	1	5	0.4000	0.4593		28	
02-0185.00	1	5	0.3158	0.4457		29	
02-0185.00	1	5	0.2718	0.4380		30	
02-0185.00	1	5	0.1674	0.4179		31	
02-0185.00	1	5	0.1674	0.4179	7	32	
02-0185.00	1	6	0.5844	0.4979	9	1	
02-0185.00	1	6	0.5380	0.4934	8	2	

02-0185.00	1	6	0.5099	0.4924	8	3
02-0185.00	1	6	0.4886	0.4907	8	4
02-0185.00	1	6	0.4707	0.4882	8	5
02-0185.00	1	6	0.4548	0.4874	8	6
02-0185.00	1	6	0.4402	0.4870	8	7
02-0185.00	1	6	0.4264	0.4855	8	8
02-0185.00	1	6	0.4131	0.4855	8	9
02-0185.00	1	6	0.4000	0.4787	8	10
02-0185.00	1	6	0.3869	0.4737	8	11
02-0185.00	1	6	0.3736	0.4721	8	12
02-0185.00	1	6	0.3598	0.4721	8	13
02-0185.00	1	6	0.3452	0.4703	8	14
02-0185.00	1	6	0.3293	0.4633	8	15
02-0185.00	1	6	0.3114	0.4591	8	16
02-0185.00	1	6	0.2901	0.4574	8	17
02-0185.00	1	6	0.2620	0.4508	8	18
02-0185.00	1	6	0.2156	0.4392	8	19
02-0185.00	1	6	0.2156	0.4392	7	20
02-0185.00	1	6	0.9483	0.5459		21
02-0185.00	1	6	0.6878	0.5143		22
02-0185.00	1	6	0.6326	0.5080		23
02-0185.00	1	6	0.6054	0.5047		24
02-0185.00	1	6	0.5751	0.5010		25
02-0185.00	1	6	0.5282	0.4950		26
02-0185.00	1	6	0.4842	0.4891		27
02-0185.00	1	6	0.4000	0.4769		28
02-0185.00	1	6	0.3158	0.4635		29
02-0185.00	1	6	0.2718	0.4559		30
02-0185.00	1	6	0.1674	0.4362		31
02-0185.00	1	6	0.1674	0.4362	7	32
02-0185.00	1	7	0.5844	0.5069	9	1
02-0185.00	1	7	0.5380	0.5027	8	2
02-0185.00	1	7	0.5099	0.5019	8	3
02-0185.00	1	7	0.4886	0.5014	8	4
02-0185.00	1	7	0.4707	0.5002	8	5
02-0185.00	1	7	0.4548	0.4968	8	6
02-0185.00	1	7	0.4402	0.4964	8	7
02-0185.00	1	7	0.4264	0.4947	8	8
02-0185.00	1	7	0.4131	0.4936	8	9
02-0185.00	1	7	0.4000	0.4888	8	10
02-0185.00	1	7	0.3869	0.4848	8	11
02-0185.00	1	7	0.3736	0.4824	8	12
02-0185.00	1	7	0.3598	0.4821	8	13
02-0185.00	1	7	0.3452	0.4811	8	14
02-0185.00	1	7	0.3293	0.4795	8	15
02-0185.00	1	7	0.3114	0.4718	8	16
02-0185.00	1	7	0.2901	0.4665	8	17
02-0185.00	1	7	0.2620	0.4576	8	18
02-0185.00	1	7	0.2156	0.4547	8	19
02-0185.00	1	7	0.2156	0.4547	7	20
02-0185.00	1	7	0.9483	0.5536		21
02-0185.00	1	7	0.6878	0.5231		22
02-0185.00	1	7	0.6326	0.5170		23
02-0185.00	1	7	0.6054	0.5139		24

02-0185.00	1	7	0.5751	0.5103		25	
02-0185.00	1	7	0.5282	0.5045		26	
02-0185.00	1	7	0.4842	0.4989		27	5 of 12
02-0185.00	1	7	0.4000	0.4873		28	
02-0185.00	1	7	0.3158	0.4746		29	
02-0185.00	1	7	0.2718	0.4675		30	
02-0185.00	1	7	0.1674	0.4490		31	
02-0185.00	1	7	0.1674	0.4490	7	32	
02-0185.00	1	8	0.5844	0.5135	9	1	
02-0185.00	1	8	0.5380	0.5131	8	2	
02-0185.00	1	8	0.5099	0.5064	8	3	
02-0185.00	1	8	0.4886	0.5061	8	4	
02-0185.00	1	8	0.4707	0.5058	8	5	
02-0185.00	1	8	0.4548	0.5057	8	6	
02-0185.00	1	8	0.4402	0.5023	8	7	
02-0185.00	1	8	0.4264	0.5022	8	8	
02-0185.00	1	8	0.4131	0.5014	8	9	
02-0185.00	1	8	0.4000	0.5013	8	10	
02-0185.00	1	8	0.3869	0.4939	8	11	
02-0185.00	1	8	0.3736	0.4917	8	12	
02-0185.00	1	8	0.3598	0.4916	8	13	
02-0185.00	1	8	0.3452	0.4873	8	14	
02-0185.00	1	8	0.3293	0.4824	8	15	
02-0185.00	1	8	0.3114	0.4785	8	16	
02-0185.00	1	8	0.2901	0.4723	8	17	
02-0185.00	1	8	0.2620	0.4642	8	18	
02-0185.00	1	8	0.2156	0.4588	8	19	
02-0185.00	1	8	0.2156	0.4588	7	20	
02-0185.00	1	8	0.9483	0.5624		21	
02-0185.00	1	8	0.6878	0.5313		22	
02-0185.00	1	8	0.6326	0.5250		23	
02-0185.00	1	8	0.6054	0.5218		24	
02-0185.00	1	8	0.5751	0.5181		25	
02-0185.00	1	8	0.5282	0.5122		26	
02-0185.00	1	8	0.4842	0.5064		27	
02-0185.00	1	8	0.4000	0.4945		28	
02-0185.00	1	8	0.3158	0.4813		29	
02-0185.00	1	8	0.2718	0.4739		30	
02-0185.00	1	8	0.1674	0.4547		31	
02-0185.00	1	8	0.1674	0.4547	7	32	
02-0185.00	1	9	0.5844	0.5281	9	1	
02-0185.00	1	9	0.5380	0.5220	8	2	
02-0185.00	1	9	0.5099	0.5162	8	3	
02-0185.00	1	9	0.4886	0.5157	8	4	
02-0185.00	1	9	0.4707	0.5153	8	5	
02-0185.00	1	9	0.4548	0.5150	8	6	
02-0185.00	1	9	0.4402	0.5138	8	7	
02-0185.00	1	9	0.4264	0.5126	8	8	
02-0185.00	1	9	0.4131	0.5092	8	9	
02-0185.00	1	9	0.4000	0.5092	8	10	
02-0185.00	1	9	0.3869	0.5068	8	11	
02-0185.00	1	9	0.3736	0.5023	8	12	
02-0185.00	1	9	0.3598	0.4984	8	13	
02-0185.00	1	9	0.3452	0.4913	8	14	

02-0185.00	1	9	0.3293	0.4888	8	15
02-0185.00	1	9	0.3114	0.4873	8	16
02-0185.00	1	9	0.2901	0.4786	8	17
02-0185.00	1	9	0.2620	0.4728	8	18
02-0185.00	1	9	0.2156	0.4630	8	19
02-0185.00	1	9	0.2156	0.4630	7	20
02-0185.00	1	9	0.9483	0.5771		21
02-0185.00	1	9	0.6878	0.5439		22
02-0185.00	1	9	0.6326	0.5372		23
02-0185.00	1	9	0.6054	0.5337		24
02-0185.00	1	9	0.5751	0.5297		25
02-0185.00	1	9	0.5282	0.5232		26
02-0185.00	1	9	0.4842	0.5168		27
02-0185.00	1	9	0.4000	0.5036		28
02-0185.00	1	9	0.3158	0.4889		29
02-0185.00	1	9	0.2718	0.4805		30
02-0185.00	1	9	0.1674	0.4585		31
02-0185.00	1	9	0.1674	0.4585	7	32
02-0185.00	1	10	0.5844	0.5435	9	1
02-0185.00	1	10	0.5380	0.5293	8	2
02-0185.00	1	10	0.5099	0.5269	8	3
02-0185.00	1	10	0.4886	0.5234	8	4
02-0185.00	1	10	0.4707	0.5230	8	5
02-0185.00	1	10	0.4548	0.5212	8	6
02-0185.00	1	10	0.4402	0.5199	8	7
02-0185.00	1	10	0.4264	0.5175	8	8
02-0185.00	1	10	0.4131	0.5162	8	9
02-0185.00	1	10	0.4000	0.5144	8	10
02-0185.00	1	10	0.3869	0.5124	8	11
02-0185.00	1	10	0.3736	0.5112	8	12
02-0185.00	1	10	0.3598	0.5068	8	13
02-0185.00	1	10	0.3452	0.4994	8	14
02-0185.00	1	10	0.3293	0.4967	8	15
02-0185.00	1	10	0.3114	0.4921	8	16
02-0185.00	1	10	0.2901	0.4833	8	17
02-0185.00	1	10	0.2620	0.4819	8	18
02-0185.00	1	10	0.2156	0.4681	8	19
02-0185.00	1	10	0.2156	0.4681	7	20
02-0185.00	1	10	0.9483	0.5883		21
02-0185.00	1	10	0.6878	0.5538		22
02-0185.00	1	10	0.6326	0.5467		23
02-0185.00	1	10	0.6054	0.5430		24
02-0185.00	1	10	0.5751	0.5388		25
02-0185.00	1	10	0.5282	0.5320		26
02-0185.00	1	10	0.4842	0.5252		27
02-0185.00	1	10	0.4000	0.5110		28
02-0185.00	1	10	0.3158	0.4952		29
02-0185.00	1	10	0.2718	0.4862		30
02-0185.00	1	10	0.1674	0.4622		31
02-0185.00	1	10	0.1674	0.4622	7	32
SM-FK-FC	1	1	0.5766	0.5542	9	1
SM-FK-FC	1	1	0.5285	0.5501	8	2
SM-FK-FC	1	1	0.4990	0.5496	8	3
SM-FK-FC	1	1	0.4763	0.5462	8	4

SM-FK-FC	1	1	0.4570	0.5435	8	5	
SM-FK-FC	1	1	0.4396	0.5425	8	6	
SM-FK-FC	1	1	0.4234	0.5422	8	7	7 of 12
SM-FK-FC	1	1	0.4077	0.5408	8	8	
SM-FK-FC	1	1	0.3923	0.5354	8	9	
SM-FK-FC	1	1	0.3766	0.5342	8	10	
SM-FK-FC	1	1	0.3604	0.5342	8	11	
SM-FK-FC	1	1	0.3430	0.5337	8	12	
SM-FK-FC	1	1	0.3237	0.5326	8	13	
SM-FK-FC	1	1	0.3010	0.5301	8	14	
SM-FK-FC	1	1	0.2715	0.5292	8	15	
SM-FK-FC	1	1	0.2234	0.5225	8	16 ←	
SM-FK-FC	1	1	0.2234	0.5225	7	17	
SM-FK-FC	1	1	0.9483	0.5823		18	
SM-FK-FC	1	1	0.6878	0.5613		19	
SM-FK-FC	1	1	0.6326	0.5574		20	
SM-FK-FC	1	1	0.6054	0.5553		21	
SM-FK-FC	1	1	0.5751	0.5531		22	
SM-FK-FC	1	1	0.5282	0.5495		23	
SM-FK-FC	1	1	0.4842	0.5460		24	
SM-FK-FC	1	1	0.4000	0.5391		25	
SM-FK-FC	1	1	0.3158	0.5318		26	
SM-FK-FC	1	1	0.2718	0.5278		27	
SM-FK-FC	1	1	0.1674	0.5179		28	
SM-FK-FC	1	1	0.1674	0.5179	7	29	
SM-FK-FC	1	2	0.5766	0.6185	9	1	
SM-FK-FC	1	2	0.5285	0.6182	8	2	
SM-FK-FC	1	2	0.4990	0.6173	8	3	
SM-FK-FC	1	2	0.4763	0.6170	8	4	
SM-FK-FC	1	2	0.4570	0.6152	8	5	
SM-FK-FC	1	2	0.4396	0.6100	8	6	
SM-FK-FC	1	2	0.4234	0.6049	8	7	
SM-FK-FC	1	2	0.4077	0.6045	8	8	
SM-FK-FC	1	2	0.3923	0.6009	8	9	
SM-FK-FC	1	2	0.3766	0.5996	8	10	
SM-FK-FC	1	2	0.3604	0.5978	8	11	
SM-FK-FC	1	2	0.3430	0.5949	8	12	
SM-FK-FC	1	2	0.3237	0.5919	8	13	
SM-FK-FC	1	2	0.3010	0.5903	8	14	
SM-FK-FC	1	2	0.2715	0.5892	8	15	
SM-FK-FC	1	2	0.2234	0.5690	8	16	
SM-FK-FC	1	2	0.2234	0.5690	7	17	
SM-FK-FC	1	2	0.9483	0.6638		18	
SM-FK-FC	1	2	0.6878	0.6355		19	
SM-FK-FC	1	2	0.6326	0.6299		20	
SM-FK-FC	1	2	0.6054	0.6271		21	
SM-FK-FC	1	2	0.5751	0.6238		22	
SM-FK-FC	1	2	0.5282	0.6186		23	
SM-FK-FC	1	2	0.4842	0.6135		24	
SM-FK-FC	1	2	0.4000	0.6031		25	
SM-FK-FC	1	2	0.3158	0.5918		26	
SM-FK-FC	1	2	0.2718	0.5855		27	
SM-FK-FC	1	2	0.1674	0.5694		28	
SM-FK-FC	1	2	0.1674	0.5694	7	29	

SM-FK-FC	1	3	0.5736	0.4690	9	1
SM-FK-FC	1	3	0.5248	0.4602	8	2
SM-FK-FC	1	3	0.4948	0.4591	8	3
SM-FK-FC	1	3	0.4715	0.4580	8	4
SM-FK-FC	1	3	0.4516	0.4568	8	5
SM-FK-FC	1	3	0.4335	0.4568	8	6
SM-FK-FC	1	3	0.4165	0.4556	8	7
SM-FK-FC	1	3	0.4000	0.4491	8	8
SM-FK-FC	1	3	0.3835	0.4380	8	9
SM-FK-FC	1	3	0.3665	0.4362	8	10
SM-FK-FC	1	3	0.3484	0.4342	8	11
SM-FK-FC	1	3	0.3285	0.4301	8	12
SM-FK-FC	1	3	0.3052	0.4301	8	13
SM-FK-FC	1	3	0.2752	0.4301	8	14
SM-FK-FC	1	3	0.2264	0.4230	8	15 ←
SM-FK-FC	1	3	0.2264	0.4230	7	16
SM-FK-FC	1	3	0.9483	0.5114		17
SM-FK-FC	1	3	0.6878	0.4815		18
SM-FK-FC	1	3	0.6326	0.4755		19
SM-FK-FC	1	3	0.6054	0.4725		20
SM-FK-FC	1	3	0.5751	0.4690		21
SM-FK-FC	1	3	0.5282	0.4633		22
SM-FK-FC	1	3	0.4842	0.4578		23
SM-FK-FC	1	3	0.4000	0.4465		24
SM-FK-FC	1	3	0.3158	0.4342		25
SM-FK-FC	1	3	0.2718	0.4273		26
SM-FK-FC	1	3	0.1674	0.4093		27
SM-FK-FC	1	3	0.1674	0.4093	7	28
SM-FK-FC	1	4	0.5766	0.5512	9	1
SM-FK-FC	1	4	0.5285	0.5471	8	2
SM-FK-FC	1	4	0.4990	0.5470	8	3
SM-FK-FC	1	4	0.4763	0.5458	8	4
SM-FK-FC	1	4	0.4570	0.5395	8	5
SM-FK-FC	1	4	0.4396	0.5354	8	6
SM-FK-FC	1	4	0.4234	0.5354	8	7
SM-FK-FC	1	4	0.4077	0.5342	8	8
SM-FK-FC	1	4	0.3923	0.5295	8	9
SM-FK-FC	1	4	0.3766	0.5277	8	10
SM-FK-FC	1	4	0.3604	0.5272	8	11
SM-FK-FC	1	4	0.3430	0.5263	8	12
SM-FK-FC	1	4	0.3237	0.5255	8	13
SM-FK-FC	1	4	0.3010	0.5212	8	14
SM-FK-FC	1	4	0.2715	0.5201	8	15
SM-FK-FC	1	4	0.2234	0.5170	8	16 ←
SM-FK-FC	1	4	0.2234	0.5170	7	17
SM-FK-FC	1	4	0.9483	0.5848		18
SM-FK-FC	1	4	0.6878	0.5603		19
SM-FK-FC	1	4	0.6326	0.5556		20
SM-FK-FC	1	4	0.6054	0.5532		21
SM-FK-FC	1	4	0.5751	0.5505		22
SM-FK-FC	1	4	0.5282	0.5462		23
SM-FK-FC	1	4	0.4842	0.5420		24
SM-FK-FC	1	4	0.4000	0.5335		25
SM-FK-FC	1	4	0.3158	0.5245		26

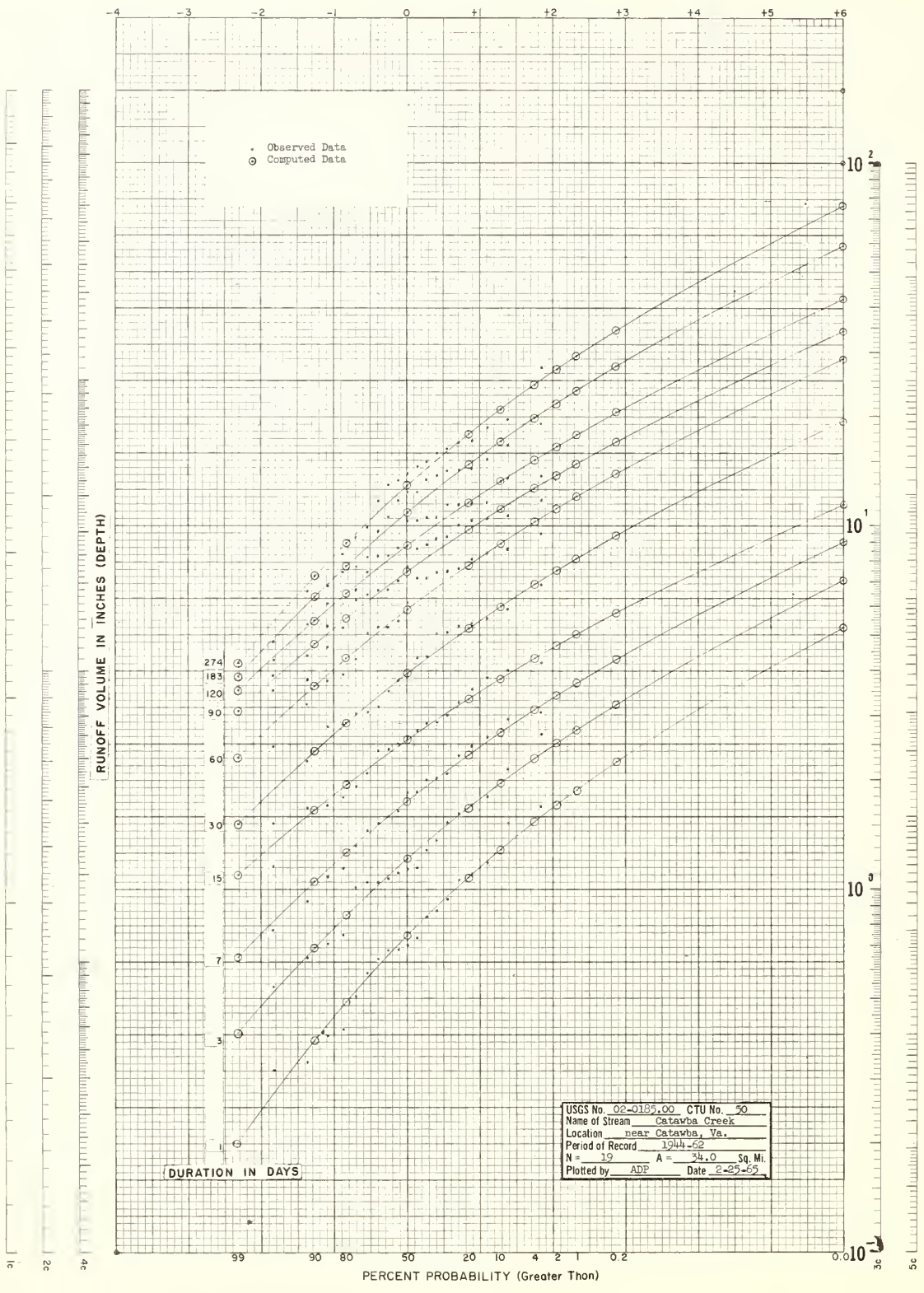
SM-FK-FC	1	4	0.2718	0.5196		27
SM-FK-FC	1	4	0.1674	0.5070		28
SM-FK-FC	1	4	0.1674	0.5070	7	29
SM-FK-FC	1	5	0.5766	0.4322	9	1
SM-FK-FC	1	5	0.5285	0.4079	8	2
SM-FK-FC	1	5	0.4990	0.4041	8	3
SM-FK-FC	1	5	0.4763	0.4041	8	4
SM-FK-FC	1	5	0.4570	0.4041	8	5
SM-FK-FC	1	5	0.4396	0.4000	8	6
SM-FK-FC	1	5	0.4234	0.3954	8	7
SM-FK-FC	1	5	0.4077	0.3903	8	8
SM-FK-FC	1	5	0.3923	0.3903	8	9
SM-FK-FC	1	5	0.3766	0.3845	8	10
SM-FK-FC	1	5	0.3604	0.3845	8	11
SM-FK-FC	1	5	0.3430	0.3845	8	12
SM-FK-FC	1	5	0.3237	0.3778	8	13
SM-FK-FC	1	5	0.3010	0.3778	8	14
SM-FK-FC	1	5	0.2715	0.3778	8	15
SM-FK-FC	1	5	0.2234	0.3778	8	16
SM-FK-FC	1	5	0.2234	0.3778	7	17
SM-FK-FC	1	5	0.9483	0.4639		18
SM-FK-FC	1	5	0.6878	0.4321		19
SM-FK-FC	1	5	0.6326	0.4257		20
SM-FK-FC	1	5	0.6054	0.4224		21
SM-FK-FC	1	5	0.5751	0.4187		22
SM-FK-FC	1	5	0.5282	0.4126		23
SM-FK-FC	1	5	0.4842	0.4066		24
SM-FK-FC	1	5	0.4000	0.3942		25
SM-FK-FC	1	5	0.3158	0.3806		26
SM-FK-FC	1	5	0.2718	0.3729		27
SM-FK-FC	1	5	0.1674	0.3529		28
SM-FK-FC	1	5	0.1674	0.3529	7	29
SM-FK-FC	1	6	0.5766	0.5524	9	1
SM-FK-FC	1	6	0.5285	0.5487	8	2
SM-FK-FC	1	6	0.4990	0.5480	8	3
SM-FK-FC	1	6	0.4763	0.5470	8	4
SM-FK-FC	1	6	0.4570	0.5405	8	5
SM-FK-FC	1	6	0.4396	0.5393	8	6
SM-FK-FC	1	6	0.4234	0.5367	8	7
SM-FK-FC	1	6	0.4077	0.5358	8	8
SM-FK-FC	1	6	0.3923	0.5308	8	9
SM-FK-FC	1	6	0.3766	0.5301	8	10
SM-FK-FC	1	6	0.3604	0.5297	8	11
SM-FK-FC	1	6	0.3430	0.5279	8	12
SM-FK-FC	1	6	0.3237	0.5279	8	13
SM-FK-FC	1	6	0.3010	0.5241	8	14
SM-FK-FC	1	6	0.2715	0.5218	8	15
SM-FK-FC	1	6	0.2234	0.5190	8	16
SM-FK-FC	1	6	0.2234	0.5190	7	17
SM-FK-FC	1	6	0.9483	0.5851		18
SM-FK-FC	1	6	0.6878	0.5613		19
SM-FK-FC	1	6	0.6326	0.5567		20
SM-FK-FC	1	6	0.6054	0.5544		21
SM-FK-FC	1	6	0.5751	0.5518		22

SM-FK-FC	1	6	0.5282	0.5476		23
SM-FK-FC	1	6	0.4842	0.5435		24
SM-FK-FC	1	6	0.4000	0.5354		25
SM-FK-FC	1	6	0.3158	0.5266		26
SM-FK-FC	1	6	0.2718	0.5219		27
SM-FK-FC	1	6	0.1674	0.5098		28
SM-FK-FC	1	6	0.1674	0.5098	7	29
SM-FK-FC	1	7	0.5766	0.5696	9	1
SM-FK-FC	1	7	0.5285	0.5662	8	2
SM-FK-FC	1	7	0.4990	0.5662	8	3
SM-FK-FC	1	7	0.4763	0.5661	8	4
SM-FK-FC	1	7	0.4570	0.5656	8	5
SM-FK-FC	1	7	0.4396	0.5653	8	6
SM-FK-FC	1	7	0.4234	0.5652	8	7
SM-FK-FC	1	7	0.4077	0.5647	8	8
SM-FK-FC	1	7	0.3923	0.5640	8	9
SM-FK-FC	1	7	0.3766	0.5639	8	10
SM-FK-FC	1	7	0.3604	0.5636	8	11
SM-FK-FC	1	7	0.3430	0.5622	8	12
SM-FK-FC	1	7	0.3237	0.5616	8	13
SM-FK-FC	1	7	0.3010	0.5605	8	14
SM-FK-FC	1	7	0.2715	0.5602	8	15
SM-FK-FC	1	7	0.2234	0.5591	8	16
SM-FK-FC	1	7	0.2234	0.5591	7	17
SM-FK-FC	1	7	0.9483	0.5790		18
SM-FK-FC	1	7	0.6878	0.5719		19
SM-FK-FC	1	7	0.6326	0.5703		20
SM-FK-FC	1	7	0.6054	0.5696		21
SM-FK-FC	1	7	0.5751	0.5688		22
SM-FK-FC	1	7	0.5282	0.5675		23
SM-FK-FC	1	7	0.4842	0.5663		24
SM-FK-FC	1	7	0.4000	0.5640		25
SM-FK-FC	1	7	0.3158	0.5617		26
SM-FK-FC	1	7	0.2718	0.5605		27
SM-FK-FC	1	7	0.1674	0.5577		28
SM-FK-FC	1	7	0.1674	0.5577	7	29
SM-FK-FC	1	8	0.5766	0.6447	9	1
SM-FK-FC	1	8	0.5285	0.6407	8	2
SM-FK-FC	1	8	0.4990	0.6400	8	3
SM-FK-FC	1	8	0.4763	0.6382	8	4
SM-FK-FC	1	8	0.4570	0.6377	8	5
SM-FK-FC	1	8	0.4396	0.6354	8	6
SM-FK-FC	1	8	0.4234	0.6337	8	7
SM-FK-FC	1	8	0.4077	0.6328	8	8
SM-FK-FC	1	8	0.3923	0.6316	8	9
SM-FK-FC	1	8	0.3766	0.6286	8	10
SM-FK-FC	1	8	0.3604	0.6281	8	11
SM-FK-FC	1	8	0.3430	0.6279	8	12
SM-FK-FC	1	8	0.3237	0.6260	8	13
SM-FK-FC	1	8	0.3010	0.6255	8	14
SM-FK-FC	1	8	0.2715	0.6253	8	15
SM-FK-FC	1	8	0.2234	0.6107	8	16
SM-FK-FC	1	8	0.2234	0.6107	7	17
SM-FK-FC	1	8	0.9483	0.6723		18

SM-FK-FC	1	8	0.6878	0.6525		19	
SM-FK-FC	1	8	0.6326	0.6488		20	
SM-FK-FC	1	8	0.6054	0.6469		21	11 of 12
SM-FK-FC	1	8	0.5751	0.6448		22	
SM-FK-FC	1	8	0.5282	0.6415		23	
SM-FK-FC	1	8	0.4842	0.6383		24	
SM-FK-FC	1	8	0.4000	0.6319		25	
SM-FK-FC	1	8	0.3158	0.6252		26	
SM-FK-FC	1	8	0.2718	0.6216		27	
SM-FK-FC	1	8	0.1674	0.6125		28	
SM-FK-FC	1	8	0.1674	0.6125	7	29	
SM-FK-FC	1	9	0.5766	0.7160	9	1	
SM-FK-FC	1	9	0.5285	0.7158	8	2	
SM-FK-FC	1	9	0.4990	0.7154	8	3	
SM-FK-FC	1	9	0.4763	0.7150	8	4	
SM-FK-FC	1	9	0.4570	0.7141	8	5	
SM-FK-FC	1	9	0.4396	0.7126	8	6	
SM-FK-FC	1	9	0.4234	0.7124	8	7	
SM-FK-FC	1	9	0.4077	0.7120	8	8	
SM-FK-FC	1	9	0.3923	0.7119	8	9	
SM-FK-FC	1	9	0.3766	0.7101	8	10	
SM-FK-FC	1	9	0.3604	0.7098	8	11	
SM-FK-FC	1	9	0.3430	0.7097	8	12	
SM-FK-FC	1	9	0.3237	0.7093	8	13	
SM-FK-FC	1	9	0.3010	0.7087	8	14	
SM-FK-FC	1	9	0.2715	0.7080	8	15	
SM-FK-FC	1	9	0.2234	0.7057	8	16	
SM-FK-FC	1	9	0.2234	0.7057	7	17	
SM-FK-FC	1	9	0.9483	0.7285		18	
SM-FK-FC	1	9	0.6878	0.7205		19	
SM-FK-FC	1	9	0.6326	0.7188		20	
SM-FK-FC	1	9	0.6054	0.7180		21	
SM-FK-FC	1	9	0.5751	0.7170		22	
SM-FK-FC	1	9	0.5282	0.7156		23	
SM-FK-FC	1	9	0.4842	0.7142		24	
SM-FK-FC	1	9	0.4000	0.7117		25	
SM-FK-FC	1	9	0.3158	0.7091		26	
SM-FK-FC	1	9	0.2718	0.7077		27	
SM-FK-FC	1	9	0.1674	0.7045		28	
SM-FK-FC	1	9	0.1674	0.7045	7	29	
SM-FK-FC	1	10	0.5766	0.5389	9	1	
SM-FK-FC	1	10	0.5285	0.5382	8	2	
SM-FK-FC	1	10	0.4990	0.5378	8	3	
SM-FK-FC	1	10	0.4763	0.5377	8	4	
SM-FK-FC	1	10	0.4570	0.5356	8	5	
SM-FK-FC	1	10	0.4396	0.5299	8	6	
SM-FK-FC	1	10	0.4234	0.5274	8	7	
SM-FK-FC	1	10	0.4077	0.5258	8	8	
SM-FK-FC	1	10	0.3923	0.5228	8	9	
SM-FK-FC	1	10	0.3766	0.5199	8	10	
SM-FK-FC	1	10	0.3604	0.5188	8	11	
SM-FK-FC	1	10	0.3430	0.5158	8	12	
SM-FK-FC	1	10	0.3237	0.5155	8	13	
SM-FK-FC	1	10	0.3010	0.5117	8	14	

SM-FK-FC	1	10	0.2715	0.5093	8	15
SM-FK-FC	1	10	0.2234	0.4954	8	16
SM-FK-FC	1	10	0.2234	0.4954	7	17
SM-FK-FC	1	10	0.9483	0.5813		18
SM-FK-FC	1	10	0.6878	0.5545		19
SM-FK-FC	1	10	0.6326	0.5493		20
SM-FK-FC	1	10	0.6054	0.5466		21
SM-FK-FC	1	10	0.5751	0.5436		22
SM-FK-FC	1	10	0.5282	0.5387		23
SM-FK-FC	1	10	0.4842	0.5339		24
SM-FK-FC	1	10	0.4000	0.5243		25
SM-FK-FC	1	10	0.3158	0.5139		26
SM-FK-FC	1	10	0.2718	0.5082		27
SM-FK-FC	1	10	0.1674	0.4935		28
SM-FK-FC	1	10	0.1674	0.4935	7	29

SCS
CTU


REDUCED VARIATE
-4
-3
-2
-1
0
+1
+2
+3
+4
+5
+6
Observed Data
Computed Data
RUNOFF VOLUME IN INCHES (DEPTH)
10^{2}
10^{1}
10^{0}
10^{-1}
274
183
120
90
60
30
15
7
3
1
DURATION IN DAYS
USGS No. 02-0185.00 CTU No. 50
Name of Stream Catawba Creek
Location near Catawba, Va.
Period of Record 1944-62
N = 19 A = 34.0 Sq. Mi.
Plotted by ADF Date 2-25-65
99
90
80
50
20
10
4
2
1
0.2
0.01
PERCENT PROBABILITY (Greater Than)

HIGHEST MEAN DISCHARGE GAMMA FUNCTION PARAMETERS FOR STATION 02-0185.00 AREA = 34.000 SET 1

YR	X(1)	LOG X(1)	CAP X(1)	YR	X(2)	LOG X(2)	CAP X(2)	YR	X(3)	LOG X(3)	CAP X(3)
49	1540.0000	3.187521	1.6845	49	814.0000	2.910624	2.6711	49	402.0000	2.604226	3.0780
54	1390.0000	3.143015	1.5204	58	655.0000	2.816241	2.1494	58	383.0000	2.583199	2.9325
48	1080.0000	3.033424	1.1813	54	547.0000	2.737987	1.7950	51	342.0000	2.534026	2.6186
53	1010.0000	3.004321	1.1048	48	521.0000	2.716838	1.7096	60	323.0000	2.509203	2.4731
59	968.0000	2.985875	1.0588	60	493.0000	2.692847	1.6178	48	305.0000	2.484300	2.3353
58	858.0000	2.933487	0.9385	53	466.0000	2.668386	1.5292	54	271.0000	2.432969	2.0750
60	796.0000	2.900913	0.8707	45	415.0000	2.618048	1.3618	55	264.0000	2.421604	2.0214
51	765.0000	2.883661	0.8368	51	392.0000	2.593286	1.2863	53	261.0000	2.416640	1.9984
45	670.0000	2.826075	0.7329	50	348.0000	2.541579	1.1420	47	242.0000	2.383815	1.8529
62	639.0000	2.805501	0.6990	55	346.0000	2.539076	1.1354	57	241.0000	2.382017	1.8453
50	622.0000	2.793791	0.6804	57	339.0000	2.530200	1.1124	45	214.0000	2.330414	1.6386
57	620.0000	2.792392	0.6782	59	326.0000	2.513218	1.0698	50	207.0000	2.315970	1.5850
47	585.0000	2.767156	0.6399	52	319.0000	2.503791	1.0468	62	198.0000	2.296665	1.5160
55	538.0000	2.730782	0.5885	62	319.0000	2.503791	1.0468	52	189.0000	2.276462	1.4471
52	462.0000	2.664642	0.5053	47	308.0000	2.488551	1.0107	46	172.0000	2.235528	1.3170
61	375.0000	2.574031	0.4102	46	228.0000	2.357935	0.7482	61	149.0000	2.173186	1.1409
44	360.0000	2.556303	0.3938	61	215.0000	2.332439	0.7055	59	141.0000	2.149219	1.0796
46	305.0000	2.484300	0.3336	44	197.0000	2.294466	0.6465	44	121.0000	2.082786	0.9265
56	290.0000	2.462398	0.3172	56	164.0000	2.214844	0.5382	56	101.0000	2.004321	0.7733

YR	X(4)	LOG X(4)	CAP X(4)	YR	X(5)	LOG X(5)	CAP X(5)	YR	X(6)	LOG X(6)	CAP X(6)
51	256.0000	2.408240	4.2003	51	210.0000	2.322219	6.8911	58	145.0000	2.161368	9.5163
60	244.0000	2.387390	4.0034	49	180.0000	2.255273	5.9067	51	131.0000	2.117271	8.5975
58	233.0000	2.367356	3.8229	48	169.0000	2.227887	5.5457	60	128.0000	2.107210	8.4006
49	216.0000	2.334454	3.5440	55	164.0000	2.214844	5.3816	49	123.0000	2.089905	8.0724
57	199.0000	2.298853	3.2651	58	161.0000	2.206826	5.2832	48	116.0000	2.064458	7.6130
55	183.0000	2.262451	3.0026	57	155.0000	2.190332	5.0863	55	114.0000	2.056905	7.4818
48	175.0000	2.243038	2.8713	60	154.0000	2.187521	5.0535	57	113.0000	2.053078	7.4161
53	174.0000	2.240549	2.8549	53	133.0000	2.123852	4.3644	53	109.0000	2.037426	7.1536
52	166.0000	2.220109	2.7236	62	132.0000	2.120574	4.3316	62	109.0000	2.037426	7.1536
62	160.0000	2.204120	2.6252	50	117.0000	2.068186	3.8393	52	93.3000	1.969882	6.1232
54	153.0000	2.184691	2.5103	52	114.0000	2.056905	3.7409	50	83.1000	1.919601	5.4538
47	148.0000	2.170262	2.4283	47	107.0000	2.029384	3.5112	46	80.2000	1.904174	5.2635
50	147.0000	2.167317	2.4119	44	96.5000	1.984527	3.1666	44	80.1000	1.903632	5.2569
46	127.0000	2.103804	2.0837	61	93.5000	1.970812	3.0682	61	76.9000	1.885926	5.0469
45	117.0000	2.068186	1.9197	54	92.9000	1.968016	3.0485	47	65.4000	1.815578	4.2922
44	109.0000	2.037426	1.7884	46	86.6000	1.937518	2.8418	54	59.4000	1.773787	3.8984
59	104.0000	2.017033	1.7064	45	85.1000	1.929929	2.7925	45	57.1000	1.756636	3.7474
61	102.0000	2.008600	1.6736	59	68.6000	1.836324	2.2511	59	49.1000	1.691081	3.2224
56	70.5000	1.848189	1.1567	56	46.3000	1.665581	1.5193	56	37.6000	1.575188	2.4677

YR	X(7)	LOG X(7)	CAP X(7)	YR	X(8)	LOG X(8)	CAP X(8)	YR	X(9)	LOG X(9)	CAP X(9)
58	119.0000	2.075547	11.7149	58	104.0000	2.017033	13.6509	49	95.3000	1.979093	19.0762
49	108.0000	2.033424	10.6320	49	103.0000	2.012837	13.5197	58	82.9000	1.918554	16.5941
51	106.0000	2.025306	10.4351	60	88.3000	1.945961	11.5902	48	76.0000	1.880814	15.2129
57	105.0000	2.021189	10.3367	62	87.7000	1.943000	11.5114	62	71.7000	1.855519	14.3522
60	102.0000	2.008600	10.0413	51	87.0000	1.939519	11.4195	60	71.1000	1.851870	14.2321
48	94.3000	1.974512	9.2833	57	86.8000	1.938520	11.3933	51	70.6000	1.848805	14.1320

55	93.5000	1.970812	9.2045	53	80.3000	1.904715	10.5401	57	68.6000	1.836324	13.7317
53	90.0000	1.954243	8.8600	48	80.2000	1.904174	10.5270	53	66.7000	1.824126	13.3513
62	87.7000	1.943000	8.6336	55	78.7000	1.895975	10.3301	52	61.8000	1.790989	12.3705
52	78.4000	1.894316	7.7180	52	78.5000	1.894870	10.3038	55	61.8000	1.790989	12.3705
46	71.6000	1.854913	7.0486	46	66.2000	1.820858	8.6894	46	58.4000	1.766413	11.6899
61	67.7000	1.830589	6.6647	50	62.9000	1.798651	8.2562	50	52.7000	1.721811	10.5490
50	67.3000	1.828015	6.6253	47	62.8000	1.797960	8.2431	47	48.1000	1.682145	9.6282
47	65.7000	1.817566	6.4678	61	56.9000	1.755112	7.4686	61	40.9000	1.611723	8.1870
44	63.4000	1.802089	6.2414	44	50.8000	1.705864	6.6680	44	38.6000	1.586587	7.7266
45	53.0000	1.724276	5.2175	45	46.4000	1.666518	6.0904	45	37.3000	1.571709	7.4663
54	47.0000	1.672098	4.6269	54	40.3000	1.605305	5.2897	54	30.5000	1.484300	6.1052
59	38.3000	1.583199	3.7704	59	33.4000	1.523747	4.3841	59	26.7000	1.426511	5.3445
56	35.8000	1.553883	3.5243	56	29.5000	1.469822	3.8721	56	21.3000	1.328380	4.2636

YR	X(10)	LOG X(10)	CAP X(10)
49	90.8000	1.958086	27.2135
48	65.5000	1.816241	19.6309
58	62.0000	1.792392	18.5819
60	57.2000	1.757396	17.1433
51	56.7000	1.753583	16.9935
62	54.4000	1.735599	16.3041
57	52.7000	1.721811	15.7946
52	49.9000	1.698100	14.9554
53	48.5000	1.685742	14.5359
55	46.5000	1.667453	13.9364
46	44.4000	1.647383	13.3070
50	43.2000	1.635484	12.9474
47	39.0000	1.591065	11.6886
45	32.9000	1.517196	9.8604
61	30.9000	1.489958	9.2610
44	27.8000	1.444045	8.3319
54	22.7000	1.356026	6.8034
59	22.0000	1.342423	6.5936
56	16.0000	1.204120	4.7953

VOLUME-DURATION-PROBABILITY ANALYSIS FOR SELECTED WATERSHEDS

NAME OF STREAM CATAWBA CREEK GAGE LOCATION NEAR CATAWBA, VA.

USGS NO. 02-0185.00 CTU NO. 50 PERIOD OF RECORD 1944-62 DRAINAGE AREA = 34.000 SQ MI

DURATION IN DAYS	1	3	7	15	30	60	90	120	183	274
N	19	19	19	19	19	19	19	19	19	19
CV	0.47594	0.41914	0.36011	0.31672	0.34202	0.33003	0.31410	0.31910	0.35525	0.39595
X BAR	730.1579	390.1053	238.2105	162.2895	124.5000	93.1684	78.6158	69.6684	56.8947	45.4263
LN G	6.487179	5.886636	5.407021	5.038064	4.762292	4.474351	4.310387	4.185910	3.969736	3.734320
G	656.6682	360.1915	222.9663	154.1712	117.0138	87.7376	74.4693	65.7533	52.9706	41.8596
RATIO X/G	1.11191	1.08305	1.06837	1.05266	1.06398	1.06190	1.05568	1.05954	1.07408	1.08521
CV*	0.48616	0.41593	0.37605	0.32877	0.36338	0.35725	0.33832	0.35019	0.39199	0.42152
Y	0.106082	0.079781	0.066134	0.051317	0.062014	0.060058	0.054185	0.057837	0.071466	0.081771
LN S.D.	0.460612	0.399451	0.363687	0.320366	0.352175	0.346577	0.329195	0.340108	0.378064	0.404403
LN S.D.*	0.473234	0.410397	0.373653	0.329145	0.361825	0.356074	0.338216	0.349428	0.388424	0.415485
LN S.D.**	0.478410	0.411930	0.383844	0.338303	0.376386	0.372160	0.352839	0.367737	0.409413	0.432668
GAMMA	4.87329	6.42883	7.72302	9.90710	8.22567	8.48839	9.39123	8.80828	7.15853	6.27614
SQR GAMMA	2.20755	2.53551	2.77903	3.14755	2.86804	2.91348	3.06451	2.96787	2.67554	2.50522
BETA	149.82867	60.68061	30.84423	16.38113	15.13555	10.97599	8.37119	7.90942	7.94783	7.23794
BETA*	0.16389	0.19912	0.23617	0.26877	0.49667	0.72035	0.82409	1.03818	1.59091	2.16927
B * S(GA)	330.7545	153.8565	85.7171	51.5605	43.4094	31.9784	25.6536	23.4742	21.2648	18.1327
B* (S(GA)	0.361787	0.504876	0.656315	0.845971	1.424466	2.098720	2.525447	3.081193	4.256559	5.434495
PERCENT CHANCE					U(B*S(GA)					
0.0	5.2459	7.0754	9.0279	11.4363	19.5152	28.7525	34.3461	42.0224	59.0312	76.3262
0.2	2.2373	3.2170	4.2872	5.7518	9.3934	13.9076	17.0136	20.5389	27.5072	34.5258
1.0	1.8700	2.7359	3.6857	5.0140	8.1047	12.0212	14.7882	17.7893	23.5436	29.3187
2.0	1.7034	2.5159	3.4094	4.6729	7.5116	11.1522	13.7606	16.5217	21.7261	26.9396
4.0	1.5295	2.2848	3.1179	4.3113	6.8854	10.2342	12.6727	15.1814	19.8126	24.4417
10.0	1.2831	1.9545	2.6990	3.7879	5.9836	8.9109	11.1001	13.2475	17.0684	20.8744
20.0	1.0766	1.6743	2.3409	3.3362	5.2107	7.7753	9.7455	11.5857	14.7295	17.8507
50.0	0.7447	1.2143	1.7456	2.5736	3.9206	5.8762	7.4658	8.8000	10.8612	12.8957
80.0	0.4896	0.8477	1.2613	1.9374	2.8641	4.3157	5.5740	6.5027	7.7407	8.9596
90.0	0.3841	0.6904	1.0492	1.6522	2.3986	3.6259	4.7297	5.4835	6.3852	7.2756
99.0	0.1997	0.4011	0.6479	1.0942	1.5095	2.3028	3.0891	3.5194	3.8488	4.1908

N = STATION YEARS, CV = COEFFICIENT OF VARIATION BY METHOD OF MOMENTS, X BAR = ARITHMETIC MEAN IN SECOND-FEET PER DAY, LN G = NATURAL LOGARITHUM OF THE GEOMETRIC MEAN(MEAN OF THE NATURAL LOGARITHMS OF THE ORIGINAL DATA), G = GEOMETRIC MEAN IN SECOND-FEET PER DAY, RATIO X/G = RATIO OF ARITHMETIC MEAN TO GEOMETRIC MEAN, CV* = COEFFICIENT OF VARIATION BY METHOD OF MAXIMUM LIKELIHOOD, Y = NATURAL LOGARITHM OF THE RATIO OF THE ARITHMETIC MEAN TO THE GEOMETRIC MEAN, LN S.D. AND LN S.D.* = STANDARD DEVIATION OF THE NATURAL LOGARITHMS FOR MAXIMUM LIKELIHOOD, BIASED AND UNBIASED RESPECTIVELY, GAMMA = SHAPE STATISTIC, SQR GAMMA = SQUARE ROOT OF GAMMA, BETA AND BETA* = RATIO OF ARITHMETIC MEAN TO GAMMA IN SECOND-FEET PER DAY AND VOLUME IN INCHES RESPECTIVELY, B * S(GA) AND B* (S(GA) = BETA TIMES THE SQUARE ROOT OF GAMMA (STANDARD DEVIATION) IN SECOND-FEET PER DAY AND VOLUME IN INCHES RESPECTIVELY, U(B*S(GA) = VOLUME IN INCHES FOR SELECTED DURATIONS AND PERCENT CHANCE AS INDICATED

REMARKS:

FORTRAN program No. 1546

by

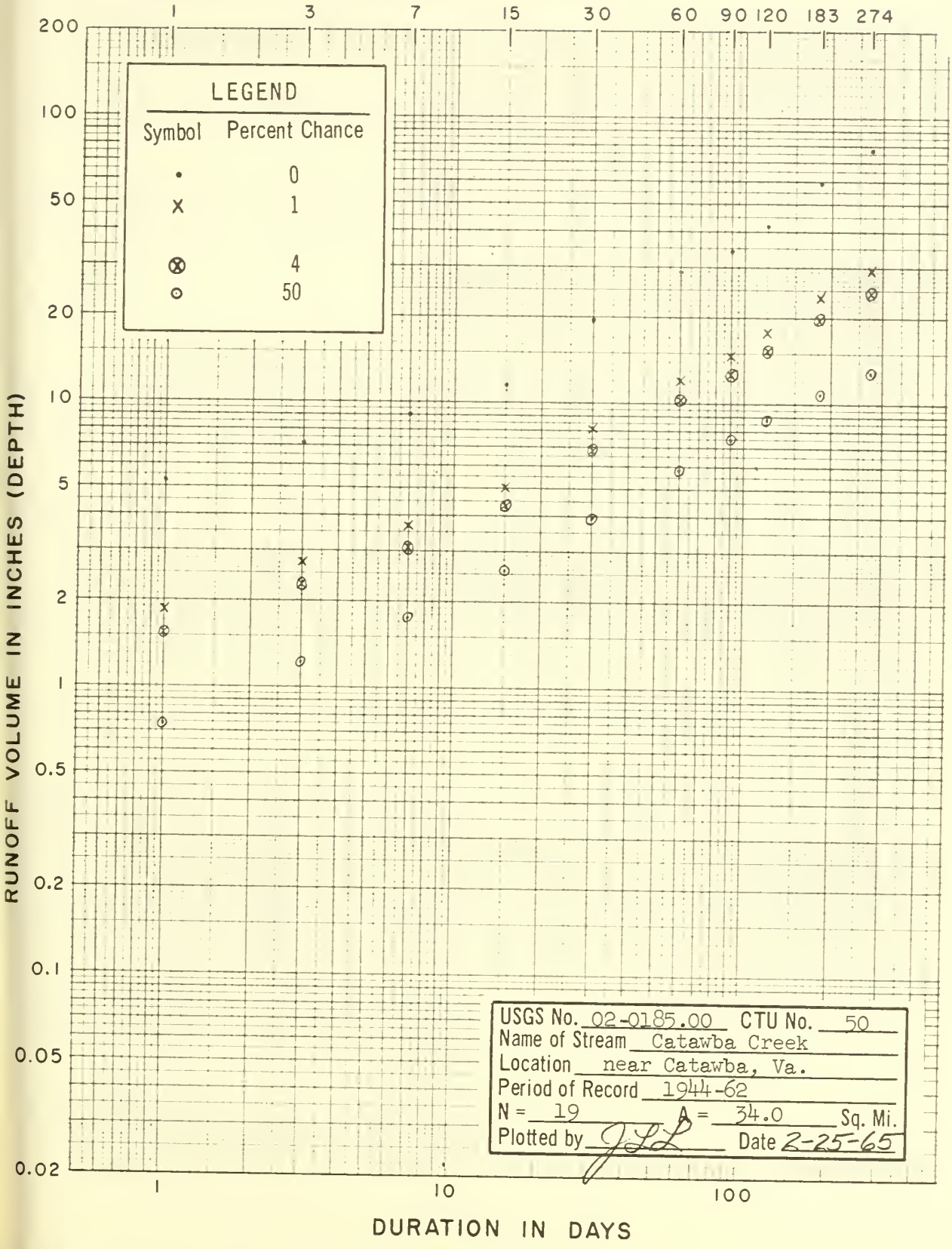
Elgin G. Fry

The program is used for plotting selected computed output of volume-duration curves for dataplotter on log-log paper, Volume-Duration-Probability Curves on an Annual Basis.

At the present time, the selected computed values are punched on cards processed to code the computed values for plotting on the automatic data plotter. Modification of program No. 0872 could give this directly from the main program, thus eliminating duplication. The coding is similar to that used in programs No. 0910 and 0911.

```
    COMPILE   RUN  FORTRAN
C     JOB NUMBER 920603-9045  PROG 1546
C     VOLUME-DURATION CURVES FOR DATAPLOTTER
C     WRITTEN BY ELGIN G. FRY   DP, SRS, USDA
      DIMENSION P(10), SOL(4,10)
      REWIND 1
      REWIND 2
      REWIND 3
      REWIND 8
      LINE = 0
      L = 1
      P(10)= 0.4438
      P(9) = 0.4262
      P(8) = 0.4079
      P(7) = 0.3954
      P(6) = 0.3778
      P(5) = 0.3477
      P(4) = 0.3176
      P(3) = 0.2845
      P(2) = 0.2477
      P(1)  = 0.2000
   10 READ INPUT TAPE 8, 12, STAT1, STAT2, AREA, KK, KODE
   12 FORMAT(2A5,F10.3,I3,I3)
      IF (KODE-999) 14,50,50
   14 READ INPUT TAPE 8, 20, ((SOL(I,J), J=1,10), I=1,4)
   20 FORMAT(4X,10F7.4)
      DO 30 I=1,4
      DO 30 J=1,10
      IF (SOL(I,J)) 30,30,28
   28 SOL(I,J) = (LOGXF(SOL(I,J)) + 2.0) * 0.1
   30 CONTINUE
      J = 0
      DO 48 I=1,4
      KSW = 1
      DO 39 JJ=1,10
      IF (SOL(I,JJ)) 39,39,41
   41 J = J + 1
      II = JJ
      IF (KSW) 60,60,70
   70 KSW = 0
      WRITE OUTPUT TAPE L, 72, STAT1, STAT2, KK, I, P(JJ), SOL(I,JJ), J
   72 FORMAT(2A5,2I3,2F8.4,19X,1H9,I8)
```

```
      GO TO 39
60    WRITE OUTPUT TAPE L, 40, STAT1, STAT2, KK, I, P(JJ), SOL(I,JJ), J
40    FORMAT(2A5,2I3,2F8.4,19X,1H8,I8)
39    CONTINUE
      J = J + 1
      WRITE OUTPUT TAPE L, 38, STAT1, STAT2, KK, I, P(II), SOL(I,II), J
38    FORMAT(2A5,2I3,2F8.4,19X,1H7,I8)
48    CONTINUE
      WRITE OUTPUT TAPE L, 80
80    FORMAT(1H   )
      LINE = LINE + J + 1
      IF (LINE-25000) 44,42,42
42    END FILE L
      REWIND L
      KKK = L + 9
      TYPE 43, LINE, KKK
43    FORMAT(I6,16H RECORDS ON UNIT,I3)
      LINE = 0
      L = L + 1
44    GO TO 10
50    REWIND 8
      END FILE L
      REWIND L
      KKK = L + 9
      TYPE 43, LINE, KKK
      TYPE 52
52    FORMAT(10HEND OF JOB)
      STOP 9999
      END
```



OLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

HIGHEST MEAN DISCHARGE GAMMA FUNCTION PARAMETERS FOR STATION SM-FK-FC AREA = 0.000 SET 1

YR	X(1)	LOG X(1)	CAP X(1)	YR	X(2)	LOG X(2)	CAP X(2)	YR	X(3)	LOG X(3)	CAP X(3)
56	34.8000	1.541579	34.8000	50	153.0000	2.184691	153.0000	53	4.9000	0.690196	4.9000
62	31.7000	1.501059	31.7000	56	152.0000	2.181843	152.0000	57	4.0000	0.602060	4.0000
51	31.3000	1.495544	31.3000	51	149.0000	2.173186	149.0000	59	3.9000	0.591065	3.9000
50	29.0000	1.462398	29.0000	57	148.0000	2.170262	148.0000	54	3.8000	0.579784	3.8000
52	27.2000	1.434569	27.2000	62	142.0000	2.152288	142.0000	55	3.7000	0.568202	3.7000
57	26.6000	1.424882	26.6000	52	126.0000	2.100371	126.0000	63	3.7000	0.568202	3.7000
54	26.4000	1.421604	26.4000	58	112.0000	2.049218	112.0000	58	3.6000	0.556303	3.6000
58	25.6000	1.408240	25.6000	48	111.0000	2.045323	111.0000	49	3.1000	0.491362	3.1000
59	22.6000	1.354108	22.6000	49	102.0000	2.008600	102.0000	52	2.4000	0.380211	2.4000
49	22.0000	1.342423	22.0000	53	99.0000	1.995635	99.0000	56	2.3000	0.361728	2.3000
63	22.0000	1.342423	22.0000	63	95.0000	1.977724	95.0000	62	2.2000	0.342423	2.2000
48	21.7000	1.336460	21.7000	54	89.0000	1.949390	89.0000	48	2.0000	0.301030	2.0000
53	21.2000	1.326336	21.2000	60	83.0000	1.919078	83.0000	60	2.0000	0.301030	2.0000
60	20.0000	1.301030	20.0000	59	80.0000	1.903090	80.0000	61	2.0000	0.301030	2.0000
55	19.6000	1.292256	19.6000	55	78.0000	1.892095	78.0000	51	1.7000	0.230449	1.7000
61	16.8000	1.225309	16.8000	61	49.0000	1.690196	49.0000	50	0.0000	0.000000	0.0000

YR	X(4)	LOG X(4)	CAP X(4)	YR	X(5)	LOG X(5)	CAP X(5)	YR	X(6)	LOG X(6)	CAP X(6)
56	32.5000	1.511883	32.5000	57	2.1000	0.322219	2.1000	56	33.4000	1.523747	33.4000
51	29.6000	1.471292	29.6000	62	1.2000	0.079181	1.2000	62	30.7000	1.487138	30.7000
62	29.5000	1.469822	29.5000	49	1.1000	0.041393	1.1000	51	30.2000	1.480007	30.2000
50	28.7000	1.457882	28.7000	53	1.1000	0.041393	1.1000	50	29.5000	1.469822	29.5000
52	24.8000	1.394452	24.8000	59	1.1000	0.041393	1.1000	52	25.4000	1.404834	25.4000
54	22.6000	1.354108	22.6000	60	1.0000	0.000000	1.0000	57	24.7000	1.392697	24.7000
57	22.6000	1.354108	22.6000	56	0.9000	-0.045757	0.9000	54	23.3000	1.367356	23.3000
58	22.0000	1.342423	22.0000	50	0.8000	-0.096910	0.8000	58	22.8000	1.357935	22.8000
48	19.7000	1.294466	19.7000	58	0.8000	-0.096910	0.8000	48	20.3000	1.307496	20.3000
49	18.9000	1.276462	18.9000	54	0.7000	-0.154902	0.7000	49	20.0000	1.301030	20.0000
59	18.7000	1.271842	18.7000	61	0.7000	-0.154902	0.7000	59	19.8000	1.296665	19.8000
63	18.3000	1.262451	18.3000	63	0.7000	-0.154902	0.7000	60	19.0000	1.278754	19.0000
60	18.0000	1.255273	18.0000	48	0.6000	-0.221849	0.6000	63	19.0000	1.278754	19.0000
53	16.3000	1.212188	16.3000	51	0.6000	-0.221849	0.6000	53	17.4000	1.240549	17.4000
55	15.9000	1.201397	15.9000	52	0.6000	-0.221849	0.6000	55	16.5000	1.217484	16.5000
61	14.8000	1.170262	14.8000	55	0.6000	-0.221849	0.6000	61	15.5000	1.190332	15.5000

YR	X(7)	LOG X(7)	CAP X(7)	YR	X(8)	LOG X(8)	CAP X(8)	YR	X(9)	LOG X(9)	CAP X(9)
56	49.7000	1.696356	49.7000	54	280.0000	2.447158	280.0000	61	1446.0000	3.160168	1446.0000
51	45.9000	1.661813	45.9000	62	255.0000	2.406540	255.0000	63	1438.0000	3.157759	1438.0000
54	45.9000	1.661813	45.9000	60	251.0000	2.399674	251.0000	55	1427.0000	3.154424	1427.0000
52	45.8000	1.660865	45.8000	59	241.0000	2.382017	241.0000	62	1413.0000	3.150142	1413.0000
59	45.3000	1.656098	45.3000	51	238.0000	2.376577	238.0000	56	1382.0000	3.140508	1382.0000
62	45.0000	1.653212	45.0000	63	226.0000	2.354108	226.0000	54	1335.0000	3.125481	1335.0000
61	44.9000	1.652246	44.9000	55	217.0000	2.336460	217.0000	60	1329.0000	3.123525	1329.0000
50	44.4000	1.647383	44.4000	53	213.0000	2.328380	213.0000	58	1318.0000	3.119915	1318.0000
48	43.6000	1.639486	43.6000	50	207.0000	2.315970	207.0000	57	1314.0000	3.118595	1314.0000
49	43.5000	1.638489	43.5000	57	193.0000	2.285557	193.0000	59	1263.0000	3.101403	1263.0000
58	43.2000	1.635484	43.2000	52	191.0000	2.281033	191.0000	53	1253.0000	3.097951	1253.0000
60	41.9000	1.622214	41.9000	61	190.0000	2.278754	190.0000	48	1250.0000	3.096910	1250.0000

55	41.3000	1.615950	41.3000
63	40.3000	1.605305	40.3000
53	40.0000	1.602060	40.0000
57	39.0000	1.591065	39.0000

YR	X(10)	LOG X(10)	CAP X(10)
50	24.5000	1.389166	24.5000
57	24.1000	1.382017	24.1000
51	23.9000	1.378398	23.9000
56	23.8000	1.376577	23.8000
62	22.7000	1.356026	22.7000
52	19.9000	1.298853	19.9000
58	18.8000	1.274158	18.8000
48	18.1000	1.257679	18.1000
49	16.9000	1.227887	16.9000
53	15.8000	1.198657	15.8000
63	15.4000	1.187521	15.4000
54	14.4000	1.158362	14.4000
60	14.3000	1.155336	14.3000
59	13.1000	1.117271	13.1000
55	12.4000	1.093422	12.4000
61	9.0000	0.954243	9.0000

58	182.0000	2.260071	182.0000
49	180.0000	2.255273	180.0000
56	179.0000	2.252853	179.0000
48	128.0000	2.107210	128.0000

50	1238.0000	3.092721	1238.0000
52	1222.0000	3.087071	1222.0000
49	1202.0000	3.079905	1202.0000
51	1140.0000	3.056905	1140.0000

NOTE

1. May 1, Snow Course Index, Inches
2. April-Sept. runoff, 1000 ac. ft. (ASTROM)
3. Soil Moisture Deficit, (all values are negative), Inches
4. Usable May 1, Snow Course Index, Inches
5. Mountain Precipitation for May, Inches
6. June 1, Usable Snow Course Index, Inches
7. Winter Wind, Boise 750 mb. (in thousands of miles)
8. Winter Temp., Nov. thru April 1, (avg. Boise-Lander 750 mb., Degree Days, Base 0 C)
9. Winter Sunshine, Nov. - April, (Total Hours of Radiation at Lander, Wyoming)
10. June 1, Snow Pack Index, Inches

VOLUME-DURATION-PROBABILITY ANALYSIS FOR SELECTED WATERSHEDS

NAME OF STREAM SMITHS FORK GAGE LOCATION NEAR BORDER WYO (165.0 sq. mi.)

USGS NO. 10-0320 CTU NO. SM-FK-FC PERIOD OF RECORD 1948-63 DRAINAGE AREA = 0.000 SQ MI

DURATION IN DAYS	1	2	3	4	5	6	7	8	9	10
N	16	16	15	16	16	16	16	16	16	16
CV	0.20120	0.28698	0.32617	0.24962	0.41562	0.24076	0.06273	0.17795	0.07047	0.26922
X BAR	24.9063	110.5000	3.0200	22.0563	0.9125	22.9688	43.7313	210.6875	1310.6250	17.9438
LN G	3.196307	4.661726	1.053827	3.065361	-0.153424	3.107712	3.776216	5.334461	7.175917	2.850251
G	24.4421	105.8185	2.8686	21.4422	0.8578	22.3698	43.6506	207.3610	1307.5583	17.2921
RATIO X/G	1.01899	1.04424	1.05277	1.02864	1.06381	1.02677	1.00185	1.01604	1.00235	1.03768
CV*	0.19581	0.30073	0.32914	0.24103	0.36289	0.23295	0.06083	0.17984	0.06853	0.27711
Y	0.018812	0.043290	0.051429	0.028235	0.061857	0.026422	0.001847	0.015915	0.002343	0.036991
LN S.D.	0.193967	0.294244	0.320715	0.237635	0.351729	0.229879	0.060780	0.178409	0.068450	0.271996
LN S.D.*	0.200328	0.303894	0.331972	0.245428	0.363264	0.237418	0.062773	0.184260	0.070695	0.280916
LN S.D.**	0.200293	0.315134	0.335174	0.243675	0.343555	0.236080	0.062803	0.188366	0.070858	0.288331
GAMMA	26.74800	11.71464	9.88591	17.87484	8.24616	19.09032	270.90680	31.58662	213.63109	13.68208
SQR GAMMA	5.17185	3.42267	3.14419	4.22786	2.87161	4.36925	16.45924	5.62020	14.61612	3.69893
BETA	0.93114	9.43264	0.30549	1.23393	0.11066	1.20316	0.16143	6.67015	6.13499	1.31148
BETA*	0.93114	9.43264	0.30549	1.23393	0.11066	1.20316	0.16143	6.67015	6.13499	1.31148
B * S(GA)	4.8157	32.2848	0.9605	5.2169	0.3178	5.2569	2.6569	37.4876	89.6698	4.8511
B* (S(GA)	4.815735	32.284772	0.960503	5.216876	0.317766	5.256914	2.656940	37.487559	89.669794	4.851066
PERCENT CHANCE					U(B*S(GA)					
0.0	66.4571	434.4585	12.9887	70.4278	4.3534	70.9683	0.0000	528.5746	0.0000	65.0043
0.2	41.0362	226.3918	6.5281	40.0782	2.0963	41.0312	0.0000	334.8399	0.0000	35.1007
1.0	37.4557	199.0961	5.6901	35.9686	1.8089	36.9315	0.0000	307.5573	0.0000	31.1095
2.0	35.7639	186.4223	5.3026	34.0422	1.6767	35.0071	0.0000	294.6268	0.0000	29.2495
4.0	33.9420	172.9505	4.8919	31.9799	1.5370	32.9447	0.0000	280.6715	0.0000	27.2671
10.0	31.2425	153.3592	4.2975	28.9498	1.3359	29.9103	0.0000	259.9298	0.0000	24.3727
20.0	28.8424	136.3511	3.7845	26.2843	1.1635	27.2360	0.0000	241.4162	0.0000	21.8471
50.0	24.5963	107.3655	2.9186	21.6459	0.8758	22.5687	0.0000	208.4674	0.0000	17.5078
80.0	20.7893	82.8215	2.1965	17.5891	0.6401	18.4685	0.0000	178.6649	0.0000	13.7862
90.0	18.9679	71.6612	1.8727	15.6897	0.5362	16.5413	0.0000	164.2978	0.0000	12.0742
99.0	15.0855	49.4159	1.2396	11.7535	0.3377	12.5270	0.0000	133.3772	0.0000	8.6079

N = STATION YEARS, CV = COEFFICIENT OF VARIATION BY METHOD OF MOMENTS, X BAR = ARITHMETIC MEAN IN SECOND-FEET PER DAY, LN G = NATURAL LOGARITHUM OF THE GEOMETRIC MEAN(MEAN OF THE NATURAL LOGARITHMS OF THE ORIGINAL DATA), G = GEOMETRIC MEAN IN SECOND-FEET PER DAY, RATIO X/G = RATIO OF ARITHMETIC MEAN TO GEOMETRIC MEAN, CV* = COEFFICIENT OF VARIATION BY METHOD OF MAXIMUM LIKELIHOOD, Y = NATURAL LOGARITHM OF THE RATIO OF THE ARITHMETIC MEAN TO THE GEOMETRIC MEAN, LN S.D. AND LN S.D.* = STANDARD DEVIATION OF THE NATURAL LOGARITHMS FOR MAXIMUM LIKELIHOOD, BIASED AND UNBIASED RESPECTIVELY, GAMMA = SHAPE STATISTIC, SQR GAMMA = SQUARE ROOT OF GAMMA, BETA AND BETA* = RATIO OF ARITHMETIC MEAN TO GAMMA IN SECOND-FEET PER DAY AND VOLUME IN INCHES RESPECTIVELY, B * S(GA) AND B* (S(GA) = BETA TIMES THE SQUARE ROOT OF GAMMA (STANDARD DEVIATION) IN SECOND-FEET PER DAY AND VOLUME IN INCHES RESPECTIVELY, U(B*S(GA) = VOLUME IN INCHES FOR SELECTED DURATIONS AND PERCENT CHANCE AS INDICATED

REMARKS: SEE LISTING PAGE 2 of 4 ABOVE FOR UNITS OF THE RESPECTIVE COLUMNS; COLUMNS 7 and 9 ARE FOR THE LOG NORMAL (SEE PAGE 4 of 4 BELOW); DISREGARD COLUMN 5, IT IS A LOG EXTREME VALUE DISTRIBUTION, (SEE SPECIAL CALCULATIONS PAGE 4 of 4)

FOR EXHIBIT ONLY

```
7     61.594162 52.298318 50.516333 49.660716 48.724632 47.310389 46.020935 43.650555 41.402266 40.273839 37.717920
9     *28.370100*03.342400*41.840500*12.408700*80.283500*31.898500*87.944400*07.558300*31.828000*94.015300*08.875300
      1928.370100          1541.840500          1480.283500          1387.944400          1231.828000          1108.875300
                1603.342400          1512.408700          1431.898500          1307.558300          1194.015300
5     T--1.01   1.05  1.11   1.25    2     5     10    25    50    100   500   10^5    RETURN PERIOD YEARS
      P-- .488  .548  .588   .647   .811  1.098 1.343 1.731 2.090 2.520 3.882 16.50   INCHES
```

BIBLIOGRAPHY

Advisory Committee on Weather Control. Tables for transformation of a unit scale gamma variate to a unit scale normal variate with zero mean. 1956. (For inservice use only.)

Aitchison, J., and J. A. C. Brown. The lognormal distributions. Cambridge Univ. Press. 1957.

Alexander, G. N. Discussion of a paper by D. M. Hershfield: An empirical comparison of predictive values of three extreme value procedures. J. Geophys. Res. 68(4): 1177-1179. 1963.

_____. Flood flow estimation, probability and return period. J. Inst. Engrs. (Australia) 29: 263-280. 1957.

_____, and A. Karoly. Discussion of the log-probability law and its engineering applications by V. T. Chow. Proc. Amer. Soc. Civ. Engr. 81: 19-23. (Separate 709) 1955.

_____. Return period relationships. J. Geophys. Res. 64(6): 675-682. 1959.

Barger, G. L., ed., assisted by J. C. Nyhan. Climatology at work. U.S. Weather Bur. 109 pp. 1960. (For sale, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402. 65 cents.)

Beard, Leo R. Estimation of flood probabilities. Proc. Amer. Soc. Civ. Engr. 80: 21 pp. (Separate 438) 1954.

_____. Probability estimates based on small normal-distribution samples. J. Geophys. Res. 65(7): 2143-2148. 1960.

Berndt, Gerald D. Power functions of the gamma distribution. Ann. Math. Statis. 29(1): 302-306; (4): 1278. 1958.

Blom, Gunnar. Statistical estimates and transformed beta-variables. John Wiley and Sons, Inc., New York. 1958.

Brakensiek, D. L. Fitting a generalized log-normal distribution to hydrological data. Trans. Amer. Geophys. Union 39(3): 469-473. 1958.

Brown, A. W. A note on the use of a Pearson Type III function in renewal theory. Ann. Math. Statis. 11(4): 448-453. 1940.

Burchinal, J. C., and W. H. Dickerson. Rainfall probability and its applications. West Virginia Agr. Expt. Sta. Bull. 454T. 1961.

Chapman, D. G. Estimating the parameters of a truncated gamma distribution. Ann. Math. Statis. 27: 498-506. 1956.

Chow, Ven Te. Determination of hydrological frequency factor. Proc. Amer. Soc. Civ. Engr. 85: 93-98. (Separate 2084, HY 7) 1959.

_____. Discussion of A nomogram for log-normal frequency analysis by L. L. Weiss. Trans. Amer. Geophys. Union 38: 33-37, 962-963. 1957.

_____. Discussion on stream flow variability. Trans. Amer. Soc. Civ. Engr. 115: 1099. 1950.

_____. A general formula for hydrologic frequency analysis. Trans. Amer. Geophys. Union 32(2): 231-237. 1951. (See comments on discussion by E. J. Gumbel 33(2): 278-282. 1952.)

_____. The log-probability law and its engineering applications. Proc. Amer. Soc. Civ. Engr. 80: (Separate 536) 1954.

Cohen, A. C., Jr. Estimating parameters in truncated Pearson frequency distributions without resort to higher moments. Biometrika 40, Pts. 1 and 2: 50-57. 1953.

_____. The numerical computation of the product of congregate imaginary gamma functions. Ann. Math. Statis. 11(2): 213-218. 1940.

Deming, W. E. The gamma and beta functions. U.S. Dept. Agr. Graduate School, Washington, D.C. 1944.

Elderton, William P. Frequency curves and correlation. Ed. 4. Harren Press, Washington, D.C. 1953.

Fisher, R. A. Contributions to mathematical statistics. John Wiley and Sons, New York. 1950. (Papers 10 and 11.)

Foster, H. Alden. Discussion of The log-probability law and its engineering applications. Proc. Amer. Soc. Civ. Engr. 81: 14-19. (Separate 709) 1955.

Friedman, Don G., and B. E. Janes. Estimation of rainfall probabilities. Conn. (Storrs) Agr. Expt. Sta. Bull. 332. 1957.

Geary, R. C. The frequency distribution of $\sqrt{b_1}$ for samples of all sizes drawn at random from a normal population. Biometrika 34, Pts. 1 and 2: 69-97. 1947.

Greenwood, J. A., and D. Durand. Aids for fitting the gamma distribution by maximum likelihood. Technometrics 2(1): 55-65. 1960.

Gringorten, Irving I. Fitting meteorological extremes by various distributions. Q. J. Royal Met. Soc. 88(376): 170-176. 1962.

_____. A plotting rule for extreme probability paper. J. Geophys. Res. 68(3): 813-814. 1963.

_____. A simplified method of estimating extreme values from data samples. J. Appl. Met. 2(1): 82-89. 1963.

_____. Envelopes for ordered observations applied to meteorological extremes. J. Geophys. Res. 68(3): 815-826. 1963.

Gumbel, E. J. Statistics of extremes. Columbia Univ. Press, New York. 1958.

Gupta, S. S. Order statistics from the gamma distribution. Technometrics 2: 243-262. 1960.

_____, and P. A. Grell. Gamma distribution in acceptance sampling based on life tests. J. Amer. Statis. Assoc. 56: 942-970. 1961.

Harter, H. Leon. Expected values of exponential, Weibull, and gamma order statistics. U.S. Air Force Aerospace Res. Lab. Tech. Rpt. 64-31, 106 pp. 1964.

_____. Expected values of normal order statistics. U.S. Air Force Aerospace Res. Lab. Tech. Rpt. 60-292. 32 pp. 1960.

_____. More tables of the incomplete gamma-function ratio and of percentage points of the chi-square distribution. U.S. Air Force Aerospace Res. Lab. Tech. Rpt. 64-123. 1964. (Our table 1 is based on table 2 of this reference.)

_____. New tables of the incomplete gamma-function ratio and of percentage points of the chi-square and beta distributions. U.S. Air Force Aerospace Res. Lab. (For sale by the Supt. of Documents, U.S. Govt. Printing Office, Washington, D.C., 20402. $2.50.) 245 pp. (Our table 2 is based on this reference.)

Hastings, C. Approximations for digital computers. Princeton Univ. Press. 1955.

Huff, F. A., and J. C. Neil. Frequency relations for storm rainfall in Illinois. Ill. State Water Survey Bull. 46. Urbana, Ill. 65 pp. 1959. (Note Summary of frequency distribution theory, pp. 9-12.)

Jambunathan, M. V. Some properties of beta and gamma distributions. Ann. Math. Statis. 25(2): 401-405. 1954.

Jenkinson, A. F. The frequency distribution of the annual maximum (or minimum) values of meteorological elements. Q. J. Royal Met. Soc. 81(348): 158-171. 1955.

Kelley, Truman Lee. The Kelley statistical tables, rev. 1948. Harvard Univ. Press, Cambridge, Mass. 1948.

Kendall, M. G., and Alan Stuart. The advanced theory of statistics. V. 2, pp. 65-67. Hafner Pub. Co., New York. 1961.

Kimball, Bradford F. The bias in certain estimates of the parameters of the extreme-value distribution. Ann. Math. Statis. 27(3): 758-767. (See table p. 763.) 1956.

Laha, R. G. On a characterization of the gamma distribution. Ann. Math. Statis. 25(4): 784-787. 1954.

Lane, E. W., and Kai Lei. Stream flow variability. Trans. Amer. Soc. Civ. Engr. 115: 1084-1098. 1950.

Lieblein, Julius. On the exact evaluation of the variances and co-variances of order statistics in samples from the extreme-value distribution. Ann. Math. Statis. 24(2): 282-287. 1953.

_____. A new method of analyzing extreme-value data. U.S. Natl. Adv. Committee Aeronaut. Tech. Note 3053. 88 pp. 1954.

_____. On moments of order statistics from the Weibull distribution. Ann. Math. Statis. 26(2): 330-333. 1955.

_____, and H. E. Salzer. Tables of the first moment of ranked extremes. U.S. Natl. Bur. Standards J. Res. 59(3): 203-206. (Res. paper 2787) 1957.

_____, and M. Zelem. Statistical investigation of the fatigue life of deep-groove ball bearings. U.S. Natl. Bur. Standards J. Res. 57(5): 273-316. (Res. paper 2719) 1956.

Moshman, Jack. Critical values of the log-normal distribution. J. Amer. Statis. Assoc. 48(263): 600-609. 1953.

Norris, Nilan. The standard errors of the geometric and harmonic means and their application to index numbers. Ann. Math. Statis. 11(4): 445-448. 1940.

Owen, D. B. Factors for one-sided tolerance limits and for variables sampling plans. Sandia Corp. Monog. SCR-607, 412 pp. (Available from U.S. Dept. Com. Off. Tech. Serv., Washington, D.C. $5.00)

Pearson, E. S., and H. O. Hartley, ed. Biometrika tables for statisticians. Ed. 2. Cambridge Univ. Press. V. 1, pp. 111-112. 1958.

Pearson, Karl. Tables of the incomplete Γ-function. H. M. Stationery Office. 1922. (Reprints for 1934 and later, Cambridge Univ. Press.)

Pinkham, R. S. An approximation to the probability integral of the gamma distribution for small values of the shape parameter. Biometrika 49, Pts. 1 and 2: 276-278. 1962.

Sammons, W. H. Discussion of The log-probability law and its engineering applications. Proc. Amer. Soc. Civ. Engr. 81: 36-41. (Separate 655) 1955. (See also Ven Te Chow closure in separate 881.)

_____. Relationship between the original and transformed variates for the logarithmic-probability law. U.S. Soil Cons. Serv. Cent. Tech. Unit. 1958. (Manuscript for inservice use.)

_____. Sample criteria for identification of outlying observations. U.S. Soil Cons. Serv. Cent. Tech. Unit. 1962. (For inservice use only.)

Sarhan, A. E., and B. C. Greenberg, ed. Contributions to order statistics. John Wiley and Sons, Inc. 1962.

Schwarz, H. E. Stream flow volume-duration-frequency studies. U.S. Army Corps of Engr. Wash. District Engr., Civ. Works Invest. Proj. CW-152, Tech. Rpt. 1. 1955.

Teichroew, Dan. A table of Millile probability points of the incomplete gamma distribution. Natl. Bur. Standards Working Paper 54-15. 1954.

Thom, H. C. S. A note on the gamma distribution. U.S. Weather Bur. Mon. Weather Rev. 86(4): 117-122. 1958.

_____. Three chapters on climatological analysis. U.S. Weather Bur. 1960. (Manuscript)

U.S. National Bureau of Standards. Probability tables for the analysis of extreme-value data. Appl. Math. Ser. 22. 1953.

_____. Statistical theory of extreme values and some practical applications. Appl. Math. Ser. 33. 1954.

Weiss, Leonard L. A nomogram for log-normal frequency analysis. Trans. Amer. Geophys. Union 38(1): 35-37. 1957.

Wilk, M. B., R. Gnanadesikan, and M. J. Huyett. Estimation of parameters of the gamma distribution using order statistics. Biometrika 49, Pts. 3 and 4: 525-545. 1962. 50. Pts. 3 and 4: 546. 1963. (See Corrigenda)

_____. Probability plots for the gamma distribution. Technometrics 4: 1-20. 1962.

Wilks, S. S. Multivariate statistical outliers. Sankhya (ser. A) 25(4): 407-426. 1963.

_____. Order statistics. Bull. Amer. Math. Soc. 54: 5-50. 1948.

Supplement No. 1

HYDROLOGY STUDY--A MULTIPURPOSE PROGRAM FOR SELECTED CUMULATIVE PROBABILITY-DISTRIBUTION ANALYSES

SCS-TP-148

```
C      PERCENTAGE POINTS OF THE INCOMPLETE GAMMA-FUNCTION RATIO FOR
C      THE FOLLOWING P-VALUES,
C      P = -.95(.05)4
C      P = 4.5(.5)38
C      P = 39(1.0)50
C      JOB NO. 920603-0010      PROGRAM NO. 1319
C      PROGRAMMED BY H.A.RICHARDSON      JULY 13, 1964
       DIMENSION A(429,5), B(195,12)
       READ   ( 5,1)          ((A(I,J), J = 1, 5), I = 1, 429)
     1 FORMAT(10X,5E14.6)
       N = 0
       DO 2 I = 1, 39
       DO 2 J = 1, 11
       K = 13 - J
       M = 5*I
       L = M - 4
       N = N + 1
       IB = 1
       DO 2 IA = L, M
       B(IA,K) = A(N,IB)
     2 IB = IB + 1
       B(1,1) = - 0.95
       DO 3 I = 2, 100
     3 B(I,1) = B(I - 1,1) + 0.05
       B(101,1) = 4.5
       DO 4 I = 102, 192
     4 B(I,1) = B(I - 1,1) + 0.5
       WRITE (6,5)
     5OFORMAT(1H1,13X,95HPERCENTAGE POINTS OF THE INCOMPLETE GAMMA-FUNCTI
      1ON RATIO FOR THE P-VALUES INDICATED IN COLUMN 1///1H0,10X,1HP,6X,
      25H1.000,4X,5H0.998,4X,5H0.990,4X,5H0.980,4X,5H0.960,4X,5H0.900,4X,
      35H0.800,4X,5H0.500,4X,5H0.200,4X,5H0.100,4X,5H0.010)
       WRITE( 9)      ((B(I,J), J = 1, 12), I = 1, 168)
       WRITE (6,6)               ((B(I,J), J = 1, 12), I = 1, 168)
     6 FORMAT(1H0/1H0,4X,12F9.3/(5X,12F9.3))
       WRITE( 9)      ((B(I,J), J = 1, 12), I = 170, 192, 2)
       WRITE (6,7)               ((B(I,J), J = 1, 12), I = 170, 192, 2)
     7 FORMAT(5X,12F9.3)
       WRITE (6,99999)
99999 FORMAT(1H1,20X,10HEND OF JOB/1H1)
       STOP
       END
```

```
C      JOB NO 9206030010  PROG 0872
C      HYDROLOGY STUDY  SCS
C      JOB NUMBER 920603-0010
C      PROGRAM NUMBER 0872
C      WRITTEN BY ELGIN G. FRY  DP-SRS-USDA
C      INPUT TAPE IS 5 AND  2
C      OUTPUT IS ON TAPE 3 AND PRINTER
C      REEL ON 3 IS INPUT TO PROGRAM 0911
C      WORK TAPE ON  4
C
C      END OF JOB CARD--NINES PUNCHED IN COLUMNS 1-30
C
C      IMPLEMENTED FOR SYSTEM /360 FORTRAN 4  BY MERLE THOMAS CORP. 12/65
      0DIMENSION X(100,10),Y(100,10),IYR(100),XLOG(100,10),CAPX(100,10),
      1IYEAR(100,10),ISTART(10), IEND(10), DAY(10), N(10), OBS(10),
      2SUMX(10), SUMXX(10), CV(10), XM(10), GM(10), SD(10), YX(10),
      3BETA(10), BETA2(10), GAMMA(10), SQGAM(10), U(10,11), P(10),CZ(10),
      4TABLE(180,12), XLN(10), PK(11), XXN(11), CHANCE(11)
       NUM = 0
       CHANCE(1) = 0.0
       CHANCE(2) = 0.2
       CHANCE(3) = 1.0
       CHANCE(4) = 2.0
       CHANCE(5) = 4.0
       CHANCE(6) = 10.0
       CHANCE(7) = 20.0
       CHANCE(8) = 50.0
       CHANCE(9) = 80.0
       CHANCE(10) = 90.0
       CHANCE(11) = 99.0
       DAY(1) = 1.0
       DAY(2) = 3.0
       DAY(3) = 7.0
       DAY(4) = 15.0
       DAY(5) = 30.0
       DAY(6) = 60.0
       DAY(7) = 90.0
       DAY(8) = 120.0
       DAY(9) = 183.0
       DAY(10) = 274.0
       PK(1) = 6.015
       PK(2) = 2.878
       PK(3) = 2.326
       PK(4) = 2.054
       PK(5) = 1.751
       PK(6) = 1.282
       PK(7) = 0.842
       PK(8) = 0.0
       PK(9) = -0.842
       PK(10) = -1.282
       PK(11) = -2.326
C      READ IN TABLE OF U VALUES FOR VARIOUS LEVELS OF PROBABILITY
       READ( 2) ((TABLE(I,J), J=1,12), I=1,168)
       READ( 2) ((TABLE(I,J), J=1,12), I=169,180)
```

```
C      READ IN PARAMETER CARD
     2 READ (5,4) STAT1,STAT2,STAT3,AREA,(ISTART(I),IEND(I),I=1,10)
     4 FORMAT(2A4,A2,F10.3,20I3)
       IF (ISTART(1)-99) 5,174,174
C      READ IN DATA CARDS
     5 K = IEND(1)
       READ (5,8) (IYR(I), (X(I,J),J=1,10), I=1,K)
     8 FORMAT(I2,7F8.1,3F7.1)
       DO 170 KK=1,10
       K1 = ISTART(KK)
       K2 = IEND(KK)
       K3 = K2 - 1
       IF (K1) 2,2,10
C      CHANGE STORAGE LOCATIONS
    10 DO 12 I=K1,K2
       DO 12 J=1,10
       XLOG(I,J) = 0.0
       Y(I,J) = X(I,J)
    12 IYEAR(I,J) = IYR(I)
C      PLACE Y VALUES ORDERED HIGH TO LOW
       DO 16 J=1,10
    13 DO 16 I=K1,K3
       IF (Y(I,J) - Y(I+1,J)) 14,16,16
    14 HOLD = Y(I,J)
       Y(I,J) = Y(I+1,J)
       Y(I+1,J) = HOLD
       IHOLD = IYEAR(I,J)
       IYEAR(I,J) = IYEAR(I+1,J)
       IYEAR(I+1,J) =IHOLD
       GO TO 13
    16 CONTINUE
C      CALCULATE LOG TO BASE 10 OF Y VALUES
       DO 18 I=K1,K2
       DO 18 J=1,10
       IF (Y(I,J)) 18,18,17
    17 XLOG(I,J) = ALOG10(Y(I,J))
    18 CONTINUE
C      CALCULATE CAP(X) VALUES
       IF (AREA) 19,19,22
    19 DO 20 I=K1,K2
       DO 20 J=1,10
    20 CAPX(I,J) = Y(I,J)
       GO TO 26
    22 CC = 0.03719008 / AREA
       DO 24 I=K1,K2
       DO 24 J=1,10
    24 CAPX(I,J) = Y(I,J) * DAY(J) * CC
C      WRITE HEADER LINES
    26 WRITE(6,28)STAT1,STAT2,STAT3,AREA,KK
   280FORMAT(1H1,10X,61HHIGHEST MEAN DISCHARGE GAMMA FUNCTION PARAMETERS
     1 FOR STATION ,2A4,A2,4X,6HAREA =,F10.3,5X,3HSET,I3)
```

```
      WRITE(6,30)
  300FORMAT(1H0,115HYR        X(1)    LOG X(1)    CAP X(1)      YR        X(
     12)    LOG X(2)    CAP X(2)      YR        X(3)    LOG X(3)    CAP X(3) )
C     WRITE DATA VALUES
      DO 32 I=K1,K2
  320WRITE (6,34) IYEAR(I,1),Y(I,1),XLOG(I,1),CAPX(I,1),
     1IYEAR(I,2), Y(I,2), XLOG(I,2), CAPX(I,2), IYEAR(I,3), Y(I,3),
     2XLOG(I,3), CAPX(I,3)
  34 FORMAT (1X,I2,F12.4,F10.6,F10.4,2(I8,F12.4,F10.6,F10.4))
      WRITE(6,36)
  360FORMAT(1H0,115HYR        X(4)    LOG X(4)    CAP X(4)      YR        X(
     15)    LOG X(5)    CAP X(5)      YR        X(6)    LOG X(6)    CAP X(6) )
C     WRITE DATA VALUES
      DO 38 I=K1,K2
  38CWRITE(6,34) IYEAR(I,4), Y(I,4),XLOG(I,4), CAPX(I,4),
     1IYEAR(I,5), Y(I,5), XLOG(I,5), CAPX(I,5), IYEAR(I,6), Y(I,6),
     2XLOG(I,6), CAPX(I,6)
      WRITE(6,40)
  400FORMAT(1H0,115HYR        X(7)    LOG X(7)    CAP X(7)      YR        X(
     18)    LOG X(8)    CAP X(8)      YR        X(9)    LOG X(9)    CAP X(9) )
C     WRITE DATA VALUES
      DO 42 I=K1,K2
  420WRITE(6,34) IYEAR(I,7), Y(I,7), XLOG(I,7), CAPX(I,7),
     1IYEAR(I,8), Y(I,8), XLOG(I,8), CAPX(I,8), IYEAR(I,9), Y(I,9),
     2XLOG(I,9), CAPX(I,9)
      WRITE(6,44)
  44 FORMAT(1H0,35HYR        X(10)  LOG X(10) CAP X(10)  )
      DO 46 I=K1,K2
  46 WRITE(6,34) IYEAR(I,10),Y(I,10), XLOG(I,10),CAPX(I,10)
      DO 41 I=K1,K2
      DO 41 J=1,10
      IF (CAPX(I,J)) 55,55,43
  55 CAPX(I,J) = -9.0
      GO TO 41
  43 CAPX(I,J) =ALOG10(CAPX(I,J))
  41 CONTINUE
      KODE = K2 - K1 + 1
      WRITE(3)   STAT1,STAT2,STAT3,AREA,KK,KODE
      WRITE (3) ((CAPX(I,J), J=1,10), I=K1,K2)
C     CALCULATE VALUE OF N FOR EACH DAY
      DO 48 I=1,10
  48 N(I) = 0
      DO 52 I=K1,K2
      DO 52 J=1,10
      IF (Y(I,J)) 52,52, 50
  50 N(J) = N(J) + 1
  52 CONTINUE
      WRITE(6,53)AREA
  530FORMAT(1H1,30X,66HVOLUME-DURATION-PROBABILITY ANALYSIS FOR SELECTE
     1D WATERSHEDS       /1H0,14HNAME OF STREAM,44X,13HGAGE LOCATION/
     21H0,8HUSGS NO.,15X,7HCTU NO.,11X,16HPERIOD OF RECORD,32X,
     315HDRAINAGE AREA =,F8.3,6H SQ MI /1H0,20HDURATION IN DAYS   1,10X,
     41H3,10X,1H7,9X,2H15,9X,2H30,9X,2H60,9X,2H90,8X,3H120,8X,3H183,8X,
     53H274 )
```

```
      DO 54 I=1,10
   54 OBS(I) = N(I)
      WRITE(6,56) (N(I), I=1,10)
   56 FORMAT(10HON         ,10I11)
C     CALCULATE MEAN, CV
      DO 58 I=1,10
      XM(I) = 0.0
      CV(I) = 0.0
      CZ(I) = 0.0
      SD(I) = 0.0
      XLN(I) = 0.0
      GM(I) = 0.0
      SUMX(I) = 0.0
   58 SUMXX(I) = 0.0
      DO 60 I=K1,K2
      DO 60 J=1,10
      SUMX(J) = SUMX(J) + Y(I,J)
   60 SUMXX(J) = SUMXX(J) + Y(I,J) * Y(I,J)
      DO 62 J=1,10
      IF (OBS(J)) 62,62,61
   61 XM(J) = SUMX(J) / OBS(J)
     0CV(J) = ((OBS(J) * OBS(J) * SUMXX(J) - OBS(J) * SUMX(J) * SUMX(J))
     1/ ((OBS(J) - 1.0) * SUMX(J) * SUMX(J))) ** 0.5
   62 CONTINUE
C     WRITE MEANS, CV, AND SD
      WRITE(6,64) (CV(I), I=1,10)
   64 FORMAT(10H CV        ,10F11.5)
      WRITE(6,66) (XM(I), I=1,10)
   66 FORMAT(10H X BAR     ,10F11.4)
C     CONVERT LOG AREA TO LOG OF X TO BASE E
      DO 70 I=K1,K2
      DO 70 J=1,10
      IF (Y(I,J)) 70,70,69
   69 XLOG(I,J) = ALOG(Y(I,J))
   70 CONTINUE
C     CALCULATE GEOMETRIC MEAN AND C(Z)
      DO 72 I=1,10
      SUMXX(I) = 0.0
   72 SUMX(I) = 0.0
      DO 74 I=K1,K2
      DO 74 J=1,10
      SUMXX(J) = SUMXX(J) + XLOG(I,J) * XLOG(I,J)
   74 SUMX(J) = SUMX(J) + XLOG(I,J)
      DO 76 J=1,10
      IF (OBS(J)) 76,76,75
  750CZ(J) = ((OBS(J) * OBS(J) * SUMXX(J) -OBS(J) * SUMX(J) *SUMX(J))
     1/ ((OBS(J) - 1.0) * SUMX(J) * SUMX(J))) ** 0.5
      SD(J) = SUMX(J) / OBS(J)
      XLN(J) = SD(J)
      CZ(J) = CZ(J) * ABS (XLN(J))
      GM(J) = EXP (SD(J))
```

```
   76 CONTINUE
C     WRITE LOG GM AND THE GM
      WRITE(6,78) (SD(I), I=1,10)
   78 FORMAT(10H LN G      ,10F11.6)
      WRITE(6,80) (GM(I), I=1,10)
   80 FORMAT(10H G         ,10F11.4)
C     CALCULATE AND WRITE RATIO OF X BAR / G
      DO 82 I=1,10
      SD(I) = 0.0
      IF (OBS(I)) 82,82,81
   81 SD(I) = XM(I) / GM(I)
   82 CONTINUE
      WRITE(6,84) (SD(I),I=1,10)
   84 FORMAT(10H RATIO X/G,10F11.5)
C     CALCULATE AND WRITE CV* AND Y
      DO 86 I=1,10
      YX(I) = 0.0
      SUMX(I) = 0.0
      IF (OBS(I)) 86,86,85
   85 SUMX(I) = (SD(I) * SD(I) - 1.0) ** 0.5
      YX(I) = ALOG(SD(I))
   86 CONTINUE
      WRITE(6,88) (SUMX(I), I=1,10)
   88 FORMAT(10H CV*       ,10F11.5)
      WRITE(6,90) (YX(I), I=1,10)
   90 FORMAT(10H Y         ,10F11.6)
C     CALCULATE LN S.D. AND LN S.D.* (USE BETA AREA)
      DO 240 I=1,10
      BETA(I) = 0.0
      IF (OBS(I)) 240,240,241
  241 BETA(I) = (YX(I) * 2.0) ** 0.5
  240 CONTINUE
      WRITE(6,242) (BETA(I),I=1,10)
  242 FORMAT(10H LN S.D.  ,10F11.6)
      DO 244 I=1,10
      IF (OBS(I)) 244,244,243
  243 BETA(I) = BETA(I) * (OBS(I) / (OBS(I) - 1.0)) ** 0.5
  244 CONTINUE
      WRITE(6,246)(BETA(I), I=1,10)
  246 FORMAT(10H LN S.D.* ,10F11.6)
      WRITE(6,245) (CZ(I), I=1,10)
  245 FORMAT(10H LN S.D.**,10F11.6)
C     CALCULATE BETA AND GAMMA AND SQR ROOT OF GAMMA
      DO 99 I=1,10
      IF (OBS(I)) 247,247,248
  247 GAMMA(I) = 0.0
      BETA(I) = 0.0
      SQGAM(I) = 0.0
      GO TO 99
  248 IF (YX(I)-0.5772) 92,94,94
  920GAMMA(I) = (1.0 / YX(I)) * (0.5000876 + 0.1648852 * YX(I)
     1- 0.0544274 * YX(I) * YX(I))
      GO TO 98
   94 IF (YX(I) - 17.0) 96,96,170
```

```
    960GAMMA(I) = (8.898919 + 9.059950 * YX(I) + 0.9775373 * YX(I) *
      1YX(I)) / (YX(I) * (17.79728 + 11.968477 * YX(I) + YX(I) * YX(I)))
     98 BETA(I) = XM(I) / GAMMA(I)
        SQGAM(I) = GAMMA(I) ** 0.5
     99 CONTINUE
        GO TO 104
C       WRITE GAMMA, SQR ROOT OF GAMMA AND BETA
    104 WRITE(6,106) (GAMMA(I), I=1,10)
    106 FORMAT(10H GAMMA     ,10F11.5)
        WRITE(6,108) (SQGAM(I), I=1,10)
    108 FORMAT(10H SQR GAMMA,10F11.5)
        WRITE(6,110) (BETA(I), I=1,10)
    110 FORMAT(10H BETA      ,10F11.5)
C       CALCULATE AND WRITE BETA STAR (PRIME)
        DO 116 I=1,10
        IF (AREA) 114,114,112
    112 IF (OBS(I)) 114,114,113
    113 BETA2(I) = DAY(I) * 0.03719 * BETA(I) / AREA
        GO TO 116
    114 BETA2(I) = BETA(I)
    116 CONTINUE
        WRITE(6,118) (BETA2(I),I=1,10)
    118 FORMAT(10H BETA*     ,10F11.5)
C       SUMX = BETA X SQR ROOT GAMMA
C       SD = BETA* X SQR ROOT GAMMA
        DO 120 I=1,10
        SUMX(I) = BETA(I) * SQGAM(I)
    120 SD(I) = BETA2(I) * SQGAM(I)
        WRITE(6,122) (SUMX(I), I=1,10)
    122 FORMAT(10H B * S(GA),10F11.4)
        WRITE(6,124) (SD(I), I=1,10)
    124 FORMAT(10H B* (S(GA),10F11.6)
        DO 126 I=1,10
    126 P(I) = GAMMA(I) - 1.0
C       CALCULATE AND STORE U * B * S(GA)
        DO 127 I=1,10
        DO 127 J=1,11
    127 U(I,J) = 0.0
        DO 152 J=1,10
        IF (OBS(J)) 152,152,129
    129 IF (P(J)-50.0) 128,128,152
    128 DO 130 I=2,180
        IF (P(J)-TABLE(I,1)) 131,144,130
    130 CONTINUE
        GO TO 152
    131 IF ((P(J)-TABLE(I-1,1)) -(TABLE(I,1)-P(J)))  132,132,133
    132 PROB = (P(J) - TABLE(I-1,1)) / (TABLE(I,1) - TABLE(I-1,1))
        SW = 0.0
        GO TO 134
    133 PROB = (TABLE(I,1)-P(J)) / (TABLE(I,1) - TABLE(I-1,1))
        SW = 1.0
```

```
  134 DO 142 M=1,11
      IF (TABLE(I-1,M+1) - TABLE(I,M+1)) 138,136,136
  136 IF (SW) 137,135,137
  137 PROBT= TABLE(I,M+1) + ((TABLE(I-1,M+1) - TABLE(I,M+1)) * PROB)
      GO TO 140
  135 PROBT = TABLE(I-1,M+1) - ((TABLE(I-1,M+1)-TABLE(I,M+1)) * PROB)
      GO TO 140
  138 IF (SW) 139,139,141
  139 PROBT= TABLE(I-1,M+1) + ((TABLE(I,M+1) - TABLE(I-1,M+1)) * PROB)
      GO TO 140
  141 PROBT = TABLE(I,M+1) - ((TABLE(I,M+1) - TABLE(I-1,M+1)) * PROB)
  140 U(J,M) = PROBT* SD(J)
  142 CONTINUE
      GO TO 152
  144 DO 146 M=1,11
  146 U(J,M) = TABLE(I,M+1) * SD(J)
  152 CONTINUE
C     WRITE U * B * S(GA) VALUES
      WRITE(6,148)
  148 FORMAT(1H0,14HPERCENT CHANCE,43X,9HU(B*S(GA))
      WRITE(6,154) (CHANCE(I), (U(J,I), J=1,10), I=1,11)
  154 FORMAT(1H ,F9.1,10F11.4)
      WRITE(6,161)
 1610FORMAT(120H0N = STATION YEARS, CV = COEFFICIENT OF VARIATION BY ME
     1THOD OF MOMENTS, X BAR = ARITHMETIC MEAN IN SECOND-FEET PER DAY, /
     2116H LN G = NATURAL LOGARITHUM OF THE GEOMETRIC MEAN(MEAN OF THE N
     3ATURAL LOGARITHMS OF THE ORIGINAL DATA), G = GEOMETRIC/ 120H MEAN
     4IN SECOND-FEET PER DAY, RATIO X/G = RATIO OF ARITHMETIC MEAN TO GE
     5OMETRIC MEAN, CV* = COEFFICIENT OF VARIATION BY /120H METHOD OF MA
     6XIMUM LIKELIHOOD, Y = NATURAL LOGARITHM OF THE RATIO OF THE ARITHM
     7ETIC MEAN TO THE GEOMETRIC MEAN, LN S.D. /114H AND LN S.D.* = STAN
     8DARD DEVIATION OF THE NATURAL LOGARITHMS FOR MAXIMUM LIKELIHOOD, B
     9IASED AND UNBIASED RESPECT-  )
      WRITE(6,185)
 1850FORMAT(120H IVELY, GAMMA = SHAPE STATISTIC, SQR GAMMA = SQUARE ROO
     1T OF GAMMA, BETA AND BETA* = RATIO OF ARITHMETIC MEAN TO GAMMA IN/
     2116H SECOND-FEET PER DAY AND VOLUME IN INCHES RESPECTIVELY, B * S(
     3GA) AND B* (S(GA) = BETA TIMES THE SQUARE ROOT OF     /120H GAMMA
     4(STANDARD DEVIATION) IN SECOND-FEET PER DAY AND VOLUME IN INCHES R
     5ESPECTIVELY, U(B*S(GA) = VOLUME IN INCHES FOR   / 51H SELECTED DUR
     6ATIONS AND PERCENT CHANCE AS INDICATED / 1H1 )
      DO 155 I=1,10
      DO 155 J=1,11
      IF (U(I,J)) 151,151,153
  151 U(I,J) = -9.0
      GO TO 155
  153 U(I,J) =ALOG10(U(I,J))
  155 CONTINUE
      DO 166 I=1,10
      IF (OBS(I)) 156,156,157
  157 IF (GAMMA(I)-51.0) 156,156,158
  156 WRITE(3)        (U(I,J), J=1,11)
      GO TO 166
C     CALCULATE LOG-NORMAL SOLUTION
```

```
  158 DO 160 J=1,11
      XXN(J) = EXP (XLN(I) + PK(J) * ABS (CZ(I)))
      IF (AREA) 160,160,183
  183 XXN(J) = XXN(J) * DAY(I) * 0.03719 / AREA
  160 CONTINUE
      WRITE(6,162) I, (XXN(J), J=1,11)
  162 FORMAT(1HO,I2,4X,11F10.6)
      DO 163 J=1,11
      IF (XXN(J)) 171,171,165
  171 XXN(J) = -9.0
      GO TO 163
  165 XXN(J) =ALOG10(XXN(J))
  163 CONTINUE
      WRITE(3)         (XXN(J), J=1,11)
  166 CONTINUE
  170 NUM = NUM + (4 * K2 + 37)
      IF (NUM-20000) 2,172,172
  172 NUM=0
      GO TO 2
  174 CONTINUE
      KODE = 999
      WRITE (3)    STAT1,STAT2,STAT3,AREA,KK,KODE
      WRITE (6,99999)
99999 FORMAT(1H1,20X,10HEND OF JOB/1H1)
      STOP 9999
      END
```

```
C      CONVERSION OF NORMAL ORDER STATISTICS
C      JOB NUMBER 920603-0010
C      PROGRAM NUMBER 0910
C      WRITTEN BY ELGIN G. FRY   DP, SRS, USDA
C      IMPLEMENTED FOR SYSTEM /360 FORTRAN 4  BY MERLE THOMAS CORP. 12/65
C
       DIMENSION X(50,100), A(100)
       READ (1,2) ((X(I,J), J=2,8), I=1,4)
       READ (1, 2) ((X(I,J), J=9,15), I=1,8)
       READ (1, 2) ((X(I,J), J=16,22), I=1,11)
       READ (1, 2) ((X(I,J), J=23,29), I=1,15)
       READ (1, 2) ((X(I,J), J=30,36), I=1,18)
       READ (1, 2) ((X(I,J), J=37,43), I=1,22)
       READ (1, 2) ((X(I,J), J=44,50), I=1,25)
       READ (1, 2) ((X(I,J), J=51,57), I=1,29)
       READ (1, 2) ((X(I,J), J=58,64), I=1,32)
       READ (1, 2) ((X(I,J), J=65,71), I=1,36)
       READ (1, 2) ((X(I,J), J=72,78), I=1,39)
       READ (1, 2) ((X(I,J), J=79,85), I=1,43)
       READ (1, 2) ((X(I,J), J=86,92), I=1,46)
       READ (1, 2) ((X(I,J), J=93,99), I=1,50)
       READ (1, 4) (X(I,100), I=1,50)
       DO 14 I=2,100
       DO 6 J=1,I
     6 A(J) = 0.0
       K = I
       M = I / 2
       DO 8 J=1,M
       A(J) = X(J,I)
       A(K) = -X(J,I)
       K = K - 1
     8 CONTINUE
       DO 10 J=1,I
    10 A(J) = A(J) + 4.0
       WRITE (4)     (A(J) , J=1,I)
    14 CONTINUE
       WRITE (6,99999)
99999 FORMAT(1H1,20X,10HEND OF JOB/1H1)
       STOP 9999
     4 FORMAT(12X,F9.5)
     2 FORMAT(12X,7F9.5)
       END
```

```
C      IMPLEMENTED FOR SYSTEM /360 FORTRAN 4  BY MERLE THOMAS CORP. 12/65
C      PREPARATION OF NORMAL ORDER STATISTICS FOR DATAPLOTTER
C      JOB NUMBER 920603-0010
C      PROGRAM NUMBER 0911
C      WRITTEN BY ELGIN G. FRY   DP, SRS, USDA
       DIMENSION X(5050), A(100), P(11), CAP(100,10), SOL(10,11), N(10)
       DO 6 I=2,100
       READ (2)   (A(J), J=1,I)
       K = I * (I - 1) / 2 + 1
       NN = I * (I + 1) / 2
       J = 0
       DO 4 M=K,NN
       J = J + 1
     4 X(M) = A(J)
     6 CONTINUE
       DO 8 I=2,5050
     8 X(I) = X(I) * 0.1
       P(1) = 0.9999
       P(2) = 0.6878
       P(3) = 0.6326
       P(4) = 0.6054
       P(5) = 0.5751
       P(6) = 0.5282
       P(7) = 0.4842
       P(8) = 0.4000
       P(9) = 0.3158
       P(10) =0.2718
       P(11) = 0.1674
    10 READ (3)    STAT1, STAT2, STAT3, AREA, KK, KODE
       IF (KODE-999) 14,50,50
    14 READ (3)   ((CAP(I,J), J=1,10), I=1,KODE)
       DO 15 I=1,10
    15 READ (3)     (SOL(I,J), J=1,11)
       DO 22 I=1,10
    22 N(I) = 0
       DO 26 I=1,KODE
       DO 26 J=1,10
       IF (CAP(I,J)+9.0) 24,27,24
    24 N(J) = N(J) + 1
    27 CAP(I,J) = (CAP(I,J) + 4.0) * 0.1
    26 CONTINUE
       DO 28 I=1,10
       DO 28 J=1,11
    28 SOL(I,J) = (SOL(I,J) + 4.0) * 0.1
       DO 44 I=1,10
       IF (N(I)) 44,44,30
    30 K = N(I) * (N(I) - 1) / 2 + 1
       NN = N(I) * (N(I) + 1) / 2
       J = 1
       WRITE (4,90) STAT1, STAT2,STAT3,KK, I, X(K), CAP(J,I), J
```

```
   90 FORMAT (1HV,2A4,A2,2I3,2F8.4,19X,1H9,I8)
      K = K + 1
      DO 36 M=K,NN
      J = J + 1
      WRITE (4,91) STAT1, STAT2,STAT3,KK,I,X(M),CAP(J,I),J
   91 FORMAT (1HV,2A4,A2,2I3,2F8.4,19X,1H8,I8)
   36 CONTINUE
      J = J + 1
      WRITE (4,92) STAT1, STAT2,STAT3, KK, I, X(NN), CAP(J-1,I), J
   92 FORMAT (1HV,2A4,A2,2I3,2F8.4,19X,1H7,I8)
      DO 39 JJ=1,11
      IF (SOL(I,JJ)) 39,39,41
   41 J = J + 1
      II = JJ
      WRITE (4,93) STAT1, STAT2,STAT3,KK,I,P(JJ),SOL(I,JJ),J
   93 FORMAT (1HV,2A4,A2,2I3,2F8.4,20X,I8)
   39 CONTINUE
      J = J + 1
      WRITE (4,92) STAT1, STAT2,STAT3,KK,I,P(II),SOL(I,II),J
   44 CONTINUE
      GO TO 10
   50 CONTINUE
      WRITE (6,99999)
99999 FORMAT(1H1,20X,10HEND OF JOB/1H1)
      STOP 9999
      END
```

```
000010 IDENTIFICATION DIVISION.                                          1141
000020 PROGRAM-ID. 'A01141'.                                             1141
000030 AUTHOR.      BRANDON APPLIED SYSTEMS, INC, G POPKIN.              1141
000040 REMARKS. NOTE-IT--FDA114110 CANNOT BE BLOCKED.                    1141
000050 ENVIRONMENT DIVISION.                                             1141
000060 CONFIGURATION SECTION.                                            1141
000070 SOURCE-COMPUTER. IBM-360 G40.                                     1141
000080 OBJECT-COMPUTER. IBM-36C G40.                                     1141
000C90 INPUT-OUTPUT SECTION.                                             1141
000100 FILE-CONTROL.                                                     1141
000110     SELECT MESSAGE ASSIGN TO 'MSGOUT' UTILITY.                    1141
000120     SELECT A114151 ASSIGN TO 'OUTPUT1' UTILITY.                   1141
000130     SELECT A114110 ASSIGN TO 'INPUT1' UTILITY.                    1141
000140 DATA DIVISION.                                                    1141
00015C FILE SECTION.                                                     1141
000160 FD  MESSAGE RECORDING F LABEL RECORD STANDARD DATA RECORD MES-TM. 1141
000170 01  MES-TM PICTURE X(160).                                       1141
00018C FD  A114110                                                       1141
000190     BLOCK CONTAINS 0001 RECORDS                                   1141
000200     RECORD CONTAINS 0165 CHARACTERS                               1141
001000     LABEL RECORDS ARE STANDARD                                    1141
001010     DATA RECORDS ARE INPUTX                                       1141
00102C     RECORDING MODE IS F.                                          1141
001030 01      INPUTX.                                                   1141
00104C     02  INPUT-XXXXXGENX.                                         1141
001050     08  STATNO PICTURE S9(011).                                  1141
001060     08  FILLER PICTURE X(011).                                   1141
00107C     08  WATERYR PICTURE S9(011).                                 1141
001080     08  HIDAY PICTURE S9(011).                                   1141
001090     08  HIDAY3 PICTURE S9(011).                                  1141
001100     08  HIDAY7 PICTURE S9(011).                                  1141
00111C     08  HIDAY15 PICTURE S9(011).                                 1141
001120     08  HIDAY30 PICTURE S9(011).                                 1141
001130     08  HIDAY60 PICTURE S9(011).                                 1141
001140     08  HIDAY90 PICTURE S9(011).                                 1141
00115C     08  HIDAY120 PICTURE S9(011).                                1141
00116C     08  FILLER PICTURE X(011).                                   1141
001170     08  HIDAY183 PICTURE S9(011).                                1141
001180     08  HIDAY274 PICTURE S9(011).                                1141
001190     08  1GENDD0012 REDEFINES HIDAY274.                           1141
001200     10  FILLER PICTURE X(004).                                   1141
002000     10  HIDAY274-XXXXX0083 PICTURE S9(003).                      1141
002010     10  HIDAY274-XXXXX0141 PICTURE S9(004).                      1141
002020     02  FILLER PICTURE X(11).                                    1141
00203C FD  A114151                                                       1141
002040     BLOCK CONTAINS 0001 RECORDS                                   1141
00205C     RECORD CONTAINS 0080 CHARACTERS                               1141
002060     LABEL RECORDS ARE STANDARD                                    1141
002070     DATA RECORDS ARE OUTPUTX                                      1141
```

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002080     RECORDING MODE IS F.                                          1141
002090 01      OUTPUTX.                                                  1141
002100     02  OUTPUT-XXXXGENX.                                         1141
002110     08  FILLER PICTURE X(080).                                   1141
002120 WORKING-STORAGE SECTION.                                         1141
002130 01  1IWX.                                                         1141
002140     02 2IW99 PICTURE 9(10).                                      1141
002150     02 FILLER REDEFINES 2IW99.                                   1141
002160     03 FILLER PICTURE 99.                                        1141
002170     03 1IW99 PICTURE 9(4).                                       1141
002180     03 0IW99 PICTURE 9(4).                                       1141
002190 01  1ELSW.                                                        1141
002200     02     1GENERELSW-001 PICTURE 9 VALUE 0.                    1141
003000     02     1ELSW02 PICTURE 9 VALUE 0.                           1141
003010     02     1ELSW03 PICTURE 9 VALUE 0.                           1141
003020     02     1ELSW04 PICTURE 9 VALUE 0.                           1141
003030     02     1ELSW05 PICTURE 9 VALUE 0.                           1141
003040     02     1ELSW06 PICTURE 9 VALUE 0.                           1141
003050     02     1ELSW07 PICTURE 9 VALUE 0.                           1141
003060     02     1ELSW08 PICTURE 9 VALUE 0.                           1141
003070     02     1ELSW09 PICTURE 9 VALUE 0.                           1141
003080     02     1ELSW10 PICTURE 9 VALUE 0.                           1141
003090     02     1ELSW11 PICTURE 9 VALUE 0.                           1141
003100     02     1ELSW12 PICTURE 9 VALUE 0.                           1141
003110     02     1ELSW13 PICTURE 9 VALUE 0.                           1141
003120     02     1ELSW14 PICTURE 9 VALUE 0.                           1141
003130     02     1ELSW15 PICTURE 9 VALUE 0.                           1141
003140     02     1ELSW16 PICTURE 9 VALUE 0.                           1141
003150     02     1ELSW17 PICTURE 9 VALUE 0.                           1141
003160     02     1ELSW18 PICTURE 9 VALUE 0.                           1141
003170     02     1ELSW19 PICTURE 9 VALUE 0.                           1141
003180     02     1ELSW20 PICTURE 9 VALUE 0.                           1141
003190     02     1ELSW21 PICTURE 9 VALUE 0.                           1141
003200     02     1ELSW22 PICTURE 9 VALUE 0.                           1141
004000     02     1ELSW23 PICTURE 9 VALUE 0.                           1141
004010     02     1ELSW24 PICTURE 9 VALUE 0.                           1141
004020     02     1ELSW25 PICTURE 9 VALUE 0.                           1141
004030     02     1ELSW26 PICTURE 9 VALUE 0.                           1141
004040     02     1ELSW27 PICTURE 9 VALUE 0.                           1141
004050     02     1ELSW28 PICTURE 9 VALUE 0.                           1141
004060     02     1ELSW29 PICTURE 9 VALUE 0.                           1141
004070     02     1ELSW30 PICTURE 9 VALUE 0.                           1141
004080 01      WORKA.                                                    1141
004090     02  WORKA-XXXXXGENX.                                         1141
004100     08  ASTATNO PICTURE 9(010).                                  1141
```

```
004110      08  1GENDD0013 REDEFINES ASTATNO.                          1141
004120      10  ASTATNO-XXXXXX0009 PICTURE 9(005).                     1141
004130      10  ASTATNO-XXXXXX0109 PICTURE 9(005).                     1141
004140      08  FILLER DISPLAY PICTURE S9(10) VALUE +0.                1141
004150      08  FILLER DISPLAY PICTURE S9(10) VALUE +0.                1141
004160      08  FILLER DISPLAY PICTURE S9(10) VALUE +0.                1141
004170      08  FILLER DISPLAY PICTURE S9(10) VALUE +0.                1141
004180      08  FILLER DISPLAY PICTURE S9(10) VALUE +0.                1141
004190      08  FILLER DISPLAY PICTURE S9(10) VALUE +0.                1141
004200      08  FILLER DISPLAY PICTURE S9(10) VALUE +0.                1141
005000      08  FILLER DISPLAY PICTURE S9(10) VALUE +0.                1141
005010      08  FILLER DISPLAY PICTURE S9(10) VALUE +0.                1141
005020      08  FILLER DISPLAY PICTURE S9(10) VALUE +0.                1141
005030      08  FILLER DISPLAY PICTURE S9(10) VALUE +0.                1141
005040      08  FILLER DISPLAY PICTURE S9(10) VALUE +0.                1141
005050      08  FILLER DISPLAY PICTURE S9(10) VALUE +0.                1141
005060 01       WORKB.                                                 1141
005070      02  WORKB-XXXXXGENX.                                       1141
005080      08  BWATERYR PICTURE 9(002).                               1141
005090      08  BHIDAY PICTURE 9(008).                                 1141
005100      08  BHIDAY3 PICTURE 9(008).                                1141
005110      08  BHIDAY7 PICTURE 9(008).                                1141
005120      08  BHIDAY15 PICTURE 9(008).                               1141
005130      08  BHIDAY30 PICTURE 9(008).                               1141
005140      08  BHIDAY60 PICTURE 9(008).                               1141
005150      08  BHIDAY90 PICTURE 9(008).                               1141
005160      08  BHIDAY120 PICTURE 9(007).                              1141
005170      08  BHIDAY183 PICTURE 9(007).                              1141
005180      08  BHIDAY274 PICTURE 9(007).                              1141
005190      08  FILLER PICTURE X(001) VALUE SPACE.                     1141
005200 01       1DCLAB0001.                                            1141
006000      02  1DCLAB0001-GENX.                                       1141
006010      08  HOLDC PICTURE X(010) VALUE '                           1141
006020      08  FILLER REDEFINES HOLDC.                                1141
006030      14  HOLD-XXXXXXXXX0009 PICTURE 9(005).                     1141
006040      14  HOLD-XXXXXXXXX0109 PICTURE 9(005).                     1141
006050      08  NINES PICTURE 9(010) VALUE 9999999999.                 1141
006060 01   001ACC.                                                    1141
006070      02 301ACC DISPLAY PICTURE S9(10).                          1141
006080      02 302ACC DISPLAY PICTURE S9(10).                          1141
006090      02 303ACC DISPLAY PICTURE S9(10).                          1141
006100 01   310ACC.                                                    1141
006110      02 FILLER PICTURE X.                                       1141
006120      02 311ACC.                                                 1141
006130      03 FILLER PICTURE X.                                       1141
006140      03 312ACC.                                                 1141
006150      04 FILLER PICTURE X.                                       1141
006160      04 313ACC.                                                 1141
006170      05 FILLER PICTURE X.                                       1141
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006180      05 314ACC PICTURE X.                                          1141
006190 01   320ACC.                                                       1141
006200      02 FILLER PICTURE X.                                          1141
007000      02 321ACC.                                                     1141
007010      03 FILLER PICTURE X.                                          1141
007020      03 322ACC.                                                     1141
007030      04 FILLER PICTURE X.                                          1141
007040      04 323ACC.                                                     1141
007050      05 FILLER PICTURE X.                                          1141
007060      05 324ACC PICTURE X.                                          1141
007070 01   330ACC.                                                       1141
007080      02 FILLER PICTURE X.                                          1141
007090      02 331ACC.                                                     1141
007100      03 FILLER PICTURE X.                                          1141
007110      03 332ACC.                                                     1141
007120      04 FILLER PICTURE X.                                          1141
007130      04 333ACC.                                                     1141
007140      05 FILLER PICTURE X.                                          1141
007150      05 334ACC PICTURE X.                                          1141
007160 01   350ACC.                                                       1141
007170      02 FILLER PICTURE X.                                          1141
007180      02 351ACC.                                                     1141
007190      03 FILLER PICTURE X.                                          1141
007200      03 352ACC.                                                     1141
008000      04 FILLER PICTURE X.                                          1141
008010      04 353ACC.                                                     1141
008020      05 FILLER PICTURE X.                                          1141
008030      05 354ACC PICTURE X.                                          1141
008040 01      STATNO-TEMP.                                               1141
008050      02 FILLER PICTURE X.                                          1141
008060      02 STATNO-TEMP01XXXXX PICTURE 9(005).                         1141
008070      02 STATNO-TEMP02XXXXX PICTURE 9(005).                         1141
008080 PROCEDURE DIVISION.                                                1141
008090      MOVE 0 TO 1GENERELSW-001.                                    1141
008100      OPEN INPUT A114110 OUTPUT A114151 MESSAGE.                    1141
008110 READX.                                                             1141
008120      READ A114110         AT END GO TO FINISH.                    1141
008130      IF 1GENERELSW-001 = 1 GO TO CKSTAT ELSE MOVE 1 TO            1141
008140      1GENERELSW-001.                                              1141
008150 NEWNO.                                                             1141
008160      MOVE STATNO TO STATNO-TEMP.                                  1141
008170      MOVE STATNO-TEMP01XXXXX TO ASTATNO-XXXXXX0009,               1141
008180                                 HOLD-XXXXXXXXX0009.               1141
008190      MOVE STATNO-TEMP02XXXXX TO ASTATNO-XXXXXX0109,               1141
008200                                 HOLD-XXXXXXXXX0109.               1141
```

```
009000      WRITE OUTPUTX FROM WORKA.                                    1141
009010      GO TO DETAILS.                                               1141
009020 CKSTAT.                                                           1141
009030      MOVE STATNO TO STATNO-TEMP.                                  1141
009040      IF STATNO-TEMP01XXXXX      = HOLD-XXXXXXXXX0009 GO TO LASTCK.  1141
009050      IF STATNO-TEMP01XXXXX * (-1)    = HOLD-XXXXXXXXX0009 GO TO   1141
009060      LASTCK ELSE GO TO NEWNO.                                     1141
009070 LASTCK.                                                           1141
009080      IF STATNO-TEMP02XXXXX NOT = HOLD-XXXXXXXXX0109 GO TO NEWNO.  1141
009090 DETAILS.                                                          1141
009100      MOVE WATERYR TO BWATERYR.                                    1141
009110      MOVE HIDAY TO BHIDAY.                                        1141
009120      MOVE HIDAY3 TO BHIDAY3.                                      1141
009130      MOVE HIDAY7 TO BHIDAY7.                                      1141
009140      MOVE HIDAY15 TO BHIDAY15.                                    1141
009150      MOVE HIDAY30 TO BHIDAY30.                                    1141
009160      MOVE HIDAY60 TO BHIDAY60.                                    1141
009170      MOVE HIDAY90 TO BHIDAY90.                                    1141
009180      MOVE HIDAY120 TO BHIDAY120.                                  1141
009190      MOVE HIDAY183 TO BHIDAY183.                                  1141
009200      MOVE HIDAY274 TO BHIDAY274.                                  1141
010000      WRITE OUTPUTX FROM WORKB.                                    1141
010010      GO TO READX.                                                 1141
010020 FINISH.                                                           1141
010030      MOVE NINES TO ASTATNO.                                       1141
010040      WRITE OUTPUTX FROM WORKA.                                    1141
010050      CLOSE A114110 A114151.                                       1141
010060      MOVE '1114101NORMAL END OF JOB' TO MES-TM.                   1141
010070      WRITE MES-TM.                                                1141
010080      CLOSE MESSAGE.                                               1141
010090      STOP RUN.                                                    1141
```

```
C       FORMATS DATA FROM GS
C       JOB NUMBER 920603-0030
C       PROGRAM NUMBER 1183
        DIMENSION X(10)
     1  READ(1,6) K,J,N
     6  FORMAT(I2,I8,1X,I8)
        IF (K-99) 32,30,30
    30  IF (J-99999999) 42,20,20
    32  IF (K-1) 34,42,42
    34  IF (N-1) 36,42,42
    36  WRITE(6,38) K,J
    38  FORMAT(1H1,I2,I8)
        WRITE(4,40) K,J
    40  FORMAT(1HV,I2,I8)
        GO TO 1
42      BACKSPACE 1
2       READ( 1,4) K,(X(I),I=1,10)
     4  FORMAT(I2,7F8.2,3F7.2)
        WRITE(6,16) K,(X(I),I=1,10)
    16  FORMAT(1H0,I2,7F8.1,3F7.1)
        WRITE(4,54) K,(X(I),I=1,10)
    54  FORMAT(1HV,I2,7F8.1,3F7.1)
        GO TO 1
    20  REWIND 1
        WRITE (6,99999)
99999   FORMAT(1H1,20X,10HEND OF JOB/1H1)
        STOP 999
        END
```